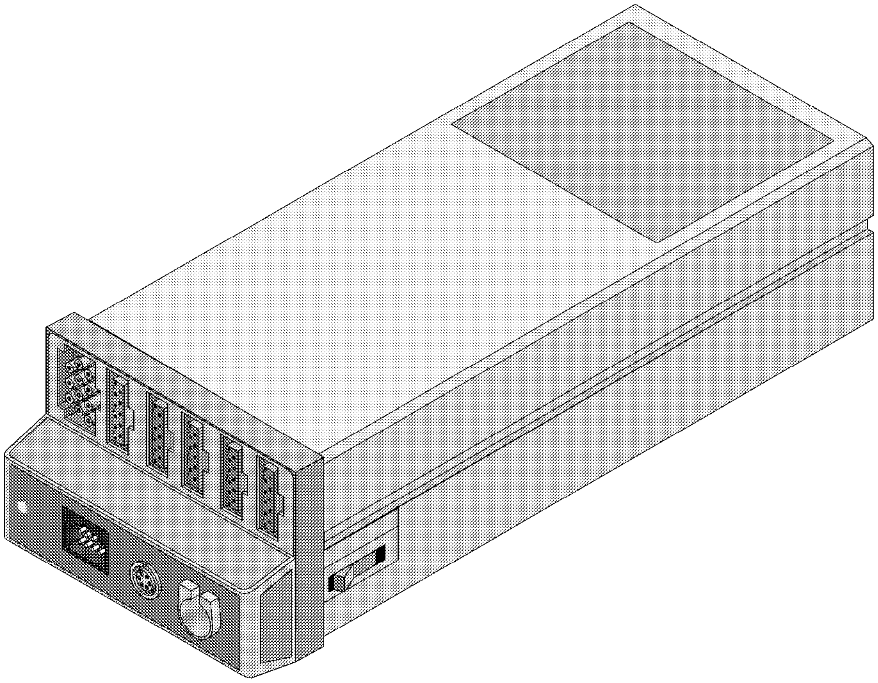
# Tram® 100-850 A and SL Modules Service Manual



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# Manual Information

## Revision History

Each page of this manual has a revision letter, located at the bottom of the page, that identifies its update level. This may be important if you have different updates to a manual and don't know which is the most current.

For the initial release, all pages have the revision letter A. For the first update of the manual, any changed pages receive the revision letter B. For the second update, any changed pages receive the revision letter C. The latest letter of the alphabet added corresponds to the most current revision. Notice, however, that some pages may skip revision letters, for example, jump from revision A to revision C because they did not change in revision B.

**Table 8-1. Revision History**

| Revision | Manual PN | Date | Comment |
|---|---|---|---|
| A | 404422-065 | 13 August 1992 | Initial release of this manual for Tram 100-800 |
| B | 404422-065 | 3 February 1994 | Updated assemblies and PCBs to latest revision |
| C | 404422-065 | 15 December 1994 | Incorporated Tram X50 modules |
| D | 404422-065 | 8 December 1995 | Added new version of processor PCB |
| E | 404422-065 | 1 May 1996 | Incorporated changes to data acquisition and NBP PCBs |
| E | 404422-065 | 14 June 1996 | Added new version of pulse oximetry PCB |

## Manual Purpose

This manual supplies technical information for service representative and technical personnel so they may maintain the equipment to the assembly level. Use it as a guide for maintenance and electrical repair considered field repairable.

Users of this manual are expected to have a strong background in electronics, including analog and digital circuity with microprocessor and micro-controller architecture.

## Chapter Content

This manual is organized into thirty chapters, summarized as follows:

### Introduction

Chapter one describes the service manual and chapter contents and provides general information on safety, service requirements, equipment symbols, and serial number identification.

### General Information

Chapter two gives a description of the equipment and provides a detailed list of technical specifications.

### Troubleshooting

Chapter three contains general fault information, troubleshooting procedure, and theory of operation.

### Calibration

Chapter four explains how and when to adjust the equipment. It also provides information about jumper and switch settings for the pcb assemblies.

### Preventive Maintenance

Chapter five describes how to maintain the equipment and keep it in good working order with a recommended maintenance schedule, cleaning guidelines, checkout procedure, and safety tests.

### Connections

Chapter six describes how the Tram modules connects to other devices and describes the signals on the modules' connectors.

### Upper Assemblies

Chapters seven through 16 make up the upper level assemblies part of this manual. Each of these sections describes one of the Tram 100-850 A and SL modules. Each chapter lists the parts that comprise the selected Tram module, shows exploded views to assist you in assembly, disassembly, and parts replacement, and provides an interconnection diagram that shows which signals go between the electronic parts of the assembly.

### Acquisition Modules

Chapters 17 through 20 make up the acquisition modules part of this manual. Each chapter lists the parts that comprise the selected data acquisition module, shows exploded views to assist you in assembly, disassembly, and parts replacement, and provides an interconnection diagram that shows which signals go between the electronic parts of the assembly.

### NBP Assembly

Chapter 21 describes the assembly that contains the noninvasive blood pressure pumps and solenoids. This chapter lists the parts that comprise the assembly, shows exploded views to assist you in assembly, disassembly, and parts replacement.

### PCB Assemblies

Chapters 22 through 30 make up the pcb assemblies part of this manual. Each chapter lists the parts that comprise the selected pcb assemblies, parts location, and schematic diagrams to assist you in parts replacement and troubleshooting to a component level. Updated data describing revisions to the circuit boards and major assemblies is also included, if applicable.

## Related Manuals

Check these documents if you need additional information on the Solar Patient Monitoring system.

**Table 8-2. Service Documents**

| Part Number | Name |
|---|---|
| 404422-052 | Tram 100-600 Hybrid Reference Manual |
| 404183-094 | Tramscope 12 Monitor Service Manual |
| 404183-048 | Tramscope 12C Monitor Service Manual |
| 414993-001 | Solar 7000/8000 Field Service Manual |
| 414993-007 | Solar 7000/8000 Data Manual |
| 404183-096 | Tram-rac Housing Service Manual |
| 404183-150 | Modular Monitor Accessories Service Manual |
| 403799-010 | Tram Critical Care Monitoring System Mounting Reference Guide |
| 403799-016 | Tram X00 Modules/Eagle Monitor Termination Instructions for BP, CO, and Temp Cables |

**Table 8-3. Operator Documents**

| Part Number | Name |
|---|---|
| 404422-103 | Tram Smart-pac Display Operator's Manual |
| 404183-176 | Tram Critical Care Monitor Operator's Manual |
| 414993-031 | Solar 7000/8000 Patient Monitor Operator's Manual |
| 403799-023 | Marquette Unity Network User's Manual |

## Tech Memos

Marquette Service issues technical memos that aid service personnel in servicing and maintaining the equipment. Tech Memos supply important information about changes to the equipment, typical problems, and how to solve those problems. Tech Memos are also written to describe hardware and software upgrades.

Tech Memos are automatically distributed to all Marquette Field Service personnel, and are available to customers by subscription. Contact Technical Support for more information or to subscribe. For the address or telephone number, see the "How to Reach Us..." pages presented later in this manual.

## BBS Tech Memo Service

Designed primarily for biomedical technicians, the BBS Tech Memo Service provides "instant" on-line access to the latest MEI maintenance and repair information. Subscribers with an IBM or IBM-compatible computer and modem can link-up to the MEITIS system and download technical publications as well as send and receive messages from technical support representatives. Call Service Contracts at 800-552-3248 for subscription information.

# Safety Information

## Responsibility of the Manufacturer

Marquette Electronics, is responsible for the effects of safety, reliability, and performance only if:

- Assembly operations, extensions, readjustments, modifications, or repairs are carried out by persons authorized by Marquette.
- The electrical installation of the relevant room complies with the requirements of the appropriate regulations.
- The equipment is used in accordance with the instructions for use.

## Intended Use

This device is intended for use under the direct supervision of a licensed health care practitioner.

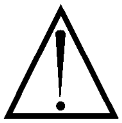
To ensure patient safety, use only parts and accessories manufactured or recommended by Marquette Electronics.

Contact Marquette Electronics for information before connecting any devices to this equipment that are not recommended in this manual.

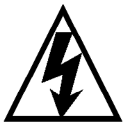
## Equipment Symbols

The following symbols appear on the equipment.

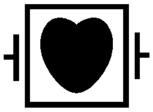
**NOTE:** Some symbols may not appear on all equipment.



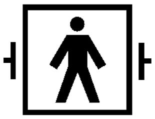
ATTENTION: Consult accompanying documents before using the equipment.



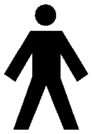
In Europe, this symbol means dangerous or high voltage. In the United States, this symbol represents the caution notice below: To reduce the risk of electric shock, do NOT remove cover (or back). Refer servicing to qualified personnel.



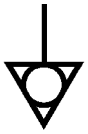
Defibrillator-proof type CF equipment; type CF equipment is specifically designed for applications where a conductive connection directly to the heart is established. The paddles indicate the equipment is defibrillator proof.



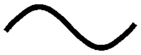
Defibrillator-proof type BF equipment; type BF equipment is specifically designed for applications intentional external and internal application to the patient, excluding direct cardiac application. Type BF equipment is type B equipment with an F-type isolated (floating) part. The paddles indicate the equipment is defibrillator proof.



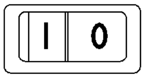
Type B equipment; type B equipment is suitable for intentional external and internal application to the patient, excluding direct cardiac application.



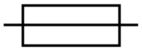
Equipotentiality



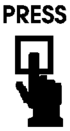
Alternating current (AC)



Power; **I** = ON; **O** = OFF



Fuse



Indicates where to press to open the door on the Series 7160 Direct Digital Writer.

## Notes, Cautions, and Warnings

Notes, cautions, and warnings are used in this manual to provide additional information to service personnel.

**NOTE**
A note conveys special instructions to service personnel to highlight an operating procedure, practice, etc. Notes may precede or follow the applicable text, depending on the material to be highlighted.

**CAUTION**
The purpose of a caution is to inform service personnel of an operating procedure, practice, etc., which if not strictly observed, could result in possible damage to the equipment. Cautions always precede the applicable text.

**WARNING**
A warning provides instructions to service personnel that if an operating procedure, practice, etc., is not followed, personal injury may result. Warnings always precede the applicable text.

# Service Information

## Service Requirements

Follow the service requirements listed below.

- Refer equipment servicing to Marquette Electronic's authorized service personnel only.
- Any unauthorized attempt to repair equipment under warranty voids that warranty.
- It is the user's responsibility to report the need for service to Marquette Electronics or to one of their authorized agents.
- Failure on the part of the responsible individual, hospital, or institution using this equipment to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards.
- Regular maintenance, irrespective of usage, is essential to ensure that the equipment will always be functional when required.

## Equipment Identification

Every Marquette Electronics device has a unique serial number for identification. The serial number appears on the product label on the base of each unit under the Trim knob control.

D 1 XX 0005 G XX

| **Month Manufactured** | **Year Manufactured** | **Product Code** | **Product Sequence Number** | **Division** | **Device Characteristics** |
|---|---|---|---|---|---|
| A = January<br>B = February<br>C = March<br>D = April<br>E = May<br>F = June<br>G = July<br>H = August<br>J = September<br>K = October<br>L = November<br>M = December | 1 = 1991<br>2 = 1992<br>3 = 1993<br>(and so on) | Two-character product descriptor | Manufacturing number (of total units manufactured.) | F = Cardiology<br>G = Monitoring | One or 2 letters that further describe the unit, for example:<br>P = prototype not conforming to marketing specification<br>R = refurbished equipment<br>S = special product documented under Specials part numbers<br>U = upgraded unit |

## Warranty

1 year.

# How to Reach Us…

The following are telephone numbers and addresses for contacting various Marquette Electronics Service and Supplies Division personnel.

## Ordering Supply Items

Supply items are generally items used during normal operation of a product. Leadwires, electrode paste, patient cables, and printer paper are examples of supply items.

Make telephone inquiries about supply items at:

1-800-558-5102

Address orders or inquiries to:

Marquette Electronics Service and Supplies
P.O. Box 9100
100 Marquette Drive
Jupiter, FL 33468-9100
Attn: Supplies

## Ordering Service Parts

Service parts are items that are not expended in the normal operation of the product. They are generally replacements for defective or malfunctioning items inside the product. Service parts include PCB assemblies, electronic components, internal cables and harnesses, software or firmware, and operator and service manuals. When ordering additional operator manuals, remember to notate the software version from the start-up screen.

A part number for the item to be replaced is necessary for ordering a service part. If the part number for the desired item is unobtainable, the following will be necessary to order the item:

- model and serial number of the equipment,
- part number/name of the assembly where the item is used,
- item name, and
- where applicable, reference designation (eg, R13, S12, U32).

## Service Calls

To open a service call with Marquette Electronics Service, contact a Service Dispatcher at:

1-800-558-7044 (U.S. only)

1-407-575-5000 (outside the U.S.)

### Service Contracts

For any questions about Service Contracts, contact the service contract operator at:

1-800-552-3248

## Technical Support

Technical Support has the most current information about your equipment and can provide assistance with any technical questions or problems.

### For All Hardware

For technical advice concerning any equipment in your Marquette Electronics monitoring system, contact Tech Support—Monitoring Hardware at:

1-800-558-7822

### Telemetry

For technical advice concerning your Telemetry system, contact Tech Support—Telemetry at:

1-800-552-3243

### Series 3000, 7000/7010

For technical advice concerning Series 3000, 7000/7010 patient monitoring equipment, contact Tech Support:

1-800-443-0980

### 48-Hour Turnaround Repair

Some Marquette products (Input Modules, Tram modules, Series 7700 ECG Telemetry Transmitters, and CD Telemetry Transmitters) are repaired on a 48-hour turnaround basis.

To inquire about status of 48-hour turnaround repair items, or if you have questions before shipping an assembly to be repaired, call:

1-800-552-3243

### Service Address

Send items for 48-hour repair and all monitoring repair items to:

Marquette Electronics Service and Supplies
P.O. Box 9100
100 Marquette Drive
Jupiter, FL  33468-9100
Attn:  Monitoring Repair

## For Additional Information

The main switchboard operator will direct your call to the person most able to assist you. For any other questions or problems, contact the main switchboard operator at:

1-800-558-5120

# 2 GENERAL INFORMATION

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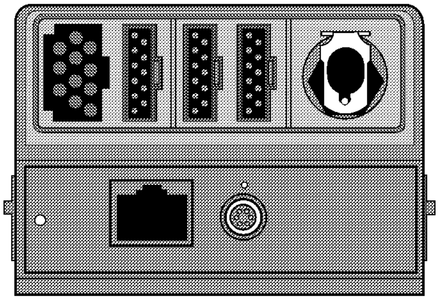
# Module Identification Chart

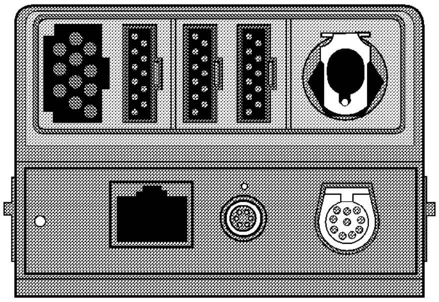
Many different module assemblies are available and many have had label changes for the same module. Below is a chart to help match the module assembly visually with its proper part number. The left column will show the different module fronts for each module type described in this manual. The right column will give all part numbers for easy access in this manual.

## Tram 100A Module



Tram 100A Module PN 408000-001 through 408000-018
Refer to Chapter 7 for more details.

## Tram 200A & SL Modules

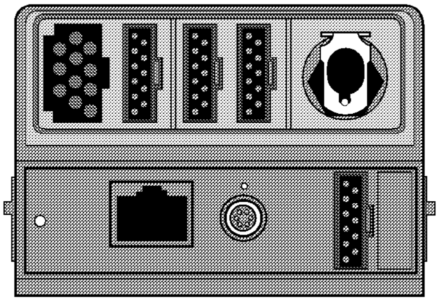


Tram 200A Module PN 408001-001 through 408000-018
Refer to Chapter 8 for more details.

Tram 200SL Module PN 408001-001
Refer to Chapter 8 for more details.

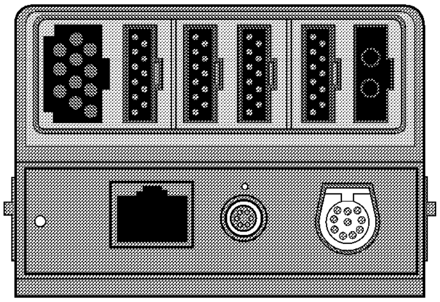
**NOTE**
The two modules listed above use a pulse oximetry PCB manufactured by Ohmeda, Inc.

## Tram 250SL Module



Tram 250SL Module PN 412651-001
Refer to Chapter 9 for more details.

## Tram 400A Module

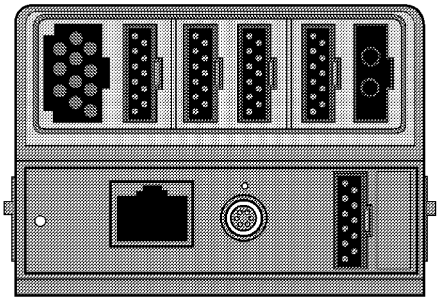


Tram 400A Module PN 408975-001
Refer to Chapter 10 for more details.

Tram 400SL Module PN 411161-001
Refer to Chapter 10 for more details.

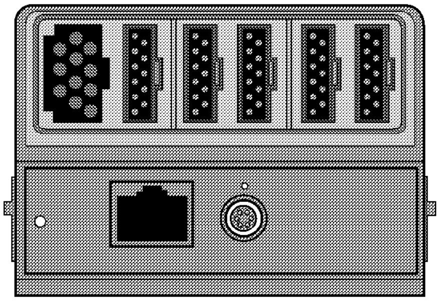
**NOTE**
The two modules listed above use a pulse oximetry PCB manufactured by Ohmeda, Inc.

## Tram 450SL Module



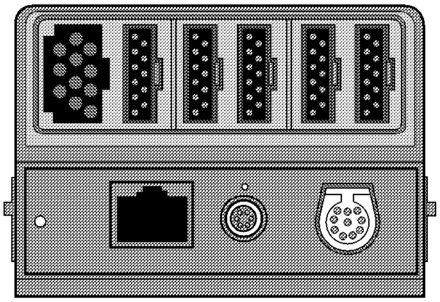
Tram 450SL Module PN 412654-001
Refer to Chapter 11 for more details.

## Tram 500A Module



Tram 500A Module PN 408003-001 through 408003-018
Refer to Chapter 12 for more details.

## Tram 600A & SL Modules

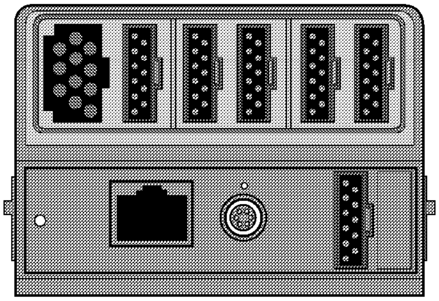


Tram 600A Module PN 408004-001 through 408003-018
Refer to Chapter 13 for more details.

Tram 600SL Module PN 411163-001
Refer to Chapter 13 for more details.

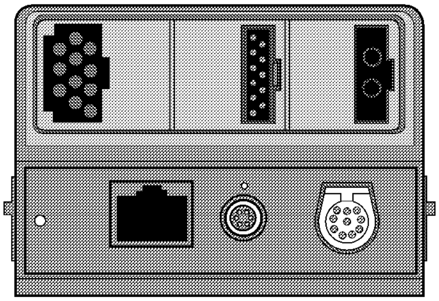
**NOTE**
The two modules listed above use a pulse oximetry PCB manufactured by Ohmeda, Inc.

## Tram 650SL Module



Tram 650SL Module PN 412656-001
Refer to Chapter 14 for more details.

## Tram 800A & SL Modules

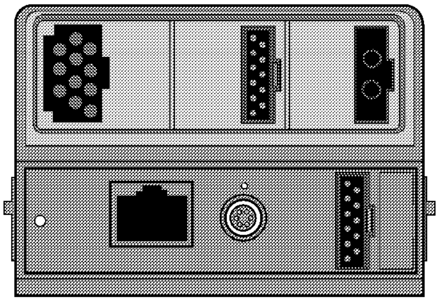


Tram 800A Module PN 411080-001
Refer to Chapter 15 for more details.

Tram 800SL Module PN 411024-001
Refer to Chapter 15 for more details.

**NOTE**
The two modules listed above use a pulse oximetry PCB manufactured by Ohmeda, Inc.

## Tram 850A & SL Modules



Tram 850A Module  PN 412657-001
Refer to Chapter 16 for more details.

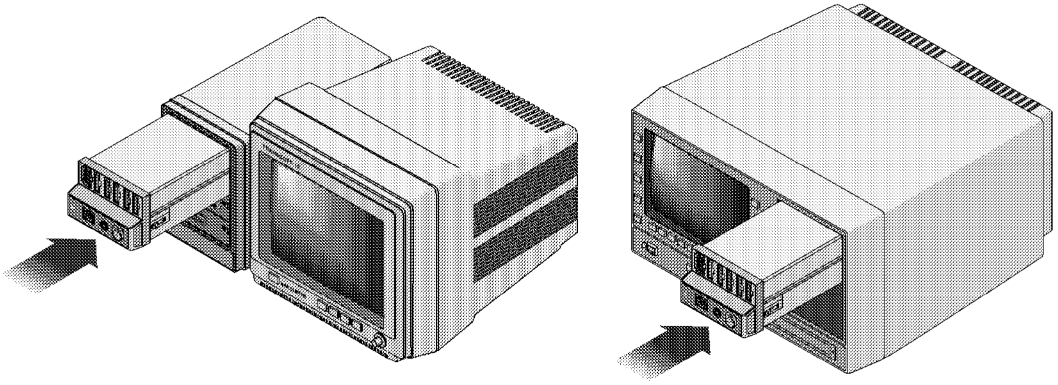
Tram 850SL Module PN 411658-001
Refer to Chapter 16 for more details.

# System Components

## What are Tram modules?

The Tram 100-850 A and SL modules are plug-in/pull-out modules used in Marquette monitoring systems and transport displays. The Tram 100-850 A and SL modules (hereafter referred to, collectively, as Tram modules) collect data from a patient, convert the data to a digital form for processing and send the data to a bedside or surgical monitor, or a transport display for further processing and display. The data that a Tram module collects, converts and sends includes the patient's vital signs and physiological waveforms.

The Tram module also stores a patient history including trends and special events, and setup information like blood pressure zero points and alarm limit settings. The patient history is stored so that when a patient is transferred to a different monitor, the collected information is transferred with them.



The following modules are *not* described in this manual and have their own service manual.

**Table 2-1. Other Module Service Manuals**

| Module | Part Number |
|---|---|
| BP/CO/Temperature Input Modules | 403798-005 |
| ABG Module | 412383-003 |
| Pulse Oximetry Module | 700-9573-002 |
| Solar ECG Module | 414993-032 |
| Solar $SpO_2$ Module | 414993-033 |
| NBP Module | 414993-059 |
| $SVO_2$ Module | 403798-007 |

## What makes each module different from each other?

Each series, or model, of Tram module monitors a different set of vital signs. This table lists the vital signs monitored by each model.

**Table 2-2. Types of Modules**

| Module Series | ECG Leadwires | RESP | NBP | SpO2 | CO | TEMPs | Inv BPs |
|---|---|---|---|---|---|---|---|
| Tram 100A | 5 | • | • |  | • | 2 | 2 |
| Tram 200A | 5 | • | • | •† | • | 2 | 2 |
| Tram 200SL | 10 | • | • | •† | • | 2 | 2 |
| Tram 250SL | 10 | • | • | • | • | 2 | 2 |
| Tram 400A | 5 | • | • | •† | • | 2 | 3 |
| Tram 400SL | 10 | • | • | •† | • | 2 | 3 |
| Tram 450SL | 10 | • | • | • | • | 2 | 3 |
| Tram 500A | 5 | • |  |  | • | 2 | 4 |
| Tram 600A | 5 | • |  | •† | • | 2 | 4 |
| Tram 600SL | 10 | • |  | •† | • | 2 | 4 |
| Tram 650SL | 10 | • |  | • | • | 2 | 4 |
| Tram 800A | 5 | • | • | •† | • | 2 | 0 |
| Tram 800SL | 10 | • | • | •† | • | 2 | 0 |
| Tram 850A | 5 | • | • | • | • | 2 | 0 |
| Tram 850SL | 10 | • | • | • | • | 2 | 0 |

† The pulse oximetry connector on this Tram module is only compatible with Ohmeda manufactured probes.

## What monitors and displays connect to my Tram module?

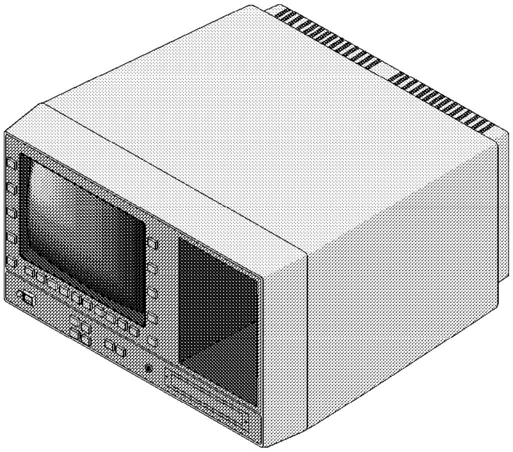
The displays and monitors listed below supply the Tram module with power, and they show the vital signs and waveforms that the Tram module collects and stores. You may use the Tram module with one of the following devices.

- Series 7005 monitor
- Series 7010 monitor
- Series 7010RA monitor
- Series 7000 or 7000RA monitor that has been modified to be Tram-compatible
- Tram Critical Care monitor (a Tramscope or Solar display equipped with any of the Tram-rac housings)
- Series 7200 Tram transport display fitted with a Smart-pac battery backpack
- Smart-pac transport display

## What is a Series 70XX-Type Patient Monitor?

A Series 70XX-type patient monitor includes a Series 7000, 7000RA, 7005, 7010, or 7010RA monitor. It is an intelligent terminal, containing the display, all of the user controls, and processors to communicate with patient monitor peripherals and analyze patient data. It is capable of displaying up to four different waveforms at one time. Modules are inserted directly into the monitor housing.

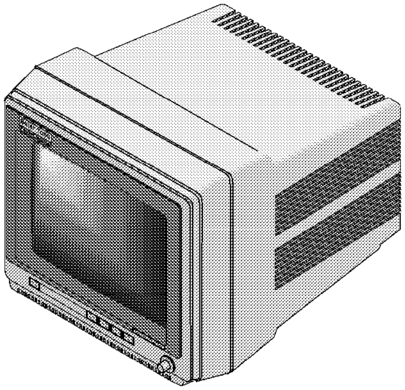
Shown below is a Series 7010 patient monitor.



## What is a Solar 7000 Patient Monitor?

One Solar based patient monitor used with the input modules is the Solar 7000 patient monitor. It is an intelligent terminal, containing the display, all of the user controls, and processors to communicate with patient monitor peripherals and analyze patient data. It is capable of displaying up to six or eight different waveforms at one time. System software may be updated by a laptop computer at the monitor or through the Marquette Unity Network using a central station.

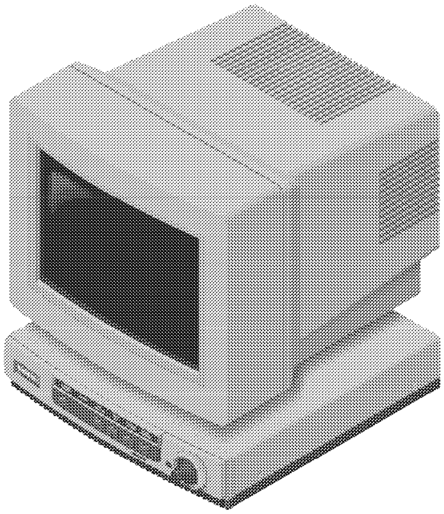
Shown below is a Solar 7000 patient monitor.



## What is a Solar 8000 Patient Monitor?

The Solar 8000 patient monitor system consists of a Solar 8000 processing unit with a compatible display purchased from Marquette Electronics or another vendor. The processing unit is the center of the Solar 8000 patient monitoring system. It provides the user controls, processors to communicate with patient monitor peripherals, and analyzes patient data. It is capable of displaying up to six or eight different waveforms at one time on the compatible 12, 15, 17, or 19-inch display. System software may be updated using a laptop computer connected to the Solar 8000 processing unit or through the Marquette Unity Network using a central station.

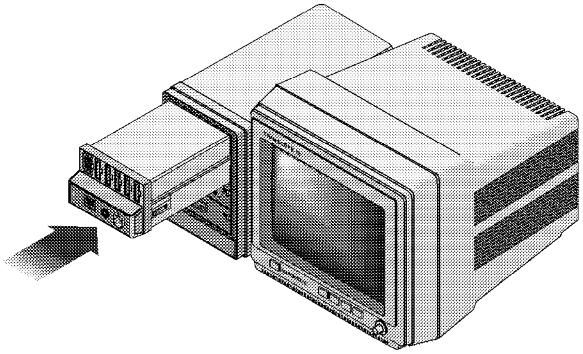
Shown below is a generic display and a Solar 8000 processing unit.



## What is a Tram-rac Housing?

The Tram-rac housing (remote acquisition case) acquires patient data for the patient monitor. *The Tram-rac Housing Service Manual*, pn 404183-096, has more information.

Shown below is a Tram module inserted in a Tramscope monitor with a Tram-rac 4A housing.



# Technical Specifications

**Table 2-3. Physical Specifications for All Tram Modules**

| Item | Description |
|---|---|
| Height | 8.1 cm (3.2 in) |
| Width | 11.4 cm (4.5 in) |
| Depth | 29.5 cm (11.6 in) |
| Weight | 2.1 kg (4.7 lb) |
| Interface | Used with Tramscope or Solar monitors |

**Table 2-4. Environmental Specifications for All Tram Modules**

| Item | Description |
|---|---|
| Power requirements | 16.5 VDC |
| Power consumption | 10 watts (module alone) |
| Cooling | Forced air |
| Heat Dissipation | 34 BTU |
| Operating conditions<br>■ Ambient temperature<br>■ Relative humidity | <br>10°C to 35°C (50°F to 95°F)<br>40% to 95% (noncondensing) |
| Storage conditions<br>■ Temperature<br>■ Relative humidity | <br>–10°C to 50°C (14°F to 122°F)<br>0 to 95% (non-condensing)) |

**Table 2-5. Processing**

| Item | Description |
|---|---|
| Main processor | Motorola 68000, 16/32 bit, 14.75 MHz |
| Input/output | Intel 80C152, 8 bit, 14.75 MHz |
| Data acquisition | Intel 80C152, 8 bit, 14.75 MHz |
| $SpO_2$ processor | Intel 80C196, 8 bit, 7.3 MHz |

| Table 2-6. ECG Parameter for All Trams for All Tram Modules | |
|---|---|
| **Item** | **Description** |
| Standard leads available<br>■ Tram 100A, 200A, 400A, 500A, 600A, and 800A modules:<br>■ Tram 200SL, 400SL, 600SL, and 800SL modules: | <br>I, II, III, V, aVR, aVL, and aVF<br>I, II, III, V1, V2, V3, V4, V5, V6, aVR, aVL, and aVF |
| Leads analyzed simultaneously | Four (I, II, III, and V) |
| Heart rate detection range | 30 to 300 beats/min |
| QRS detection range | 0.5 mV to 5 mV |
| Signal width | 40 ms to 120 ms (Q to S) |
| Common mode rejection | 90 dB min |
| Frequency response<br>■ OR<br>■ Neonate<br>■ Adult | <br>0.05 Hz to 25 Hz<br>0.5 Hz to 40 Hz<br>0.05 Hz to 100 Hz |
| Pacemaker detection/rejection<br>■ Input voltage range<br>■ Input pulse width<br>■ Rise time<br>■ Over/under shoot<br>■ Baseline drift | <br>±2 mV to ±700 mV<br>0.1 ms to 2 ms<br>10 µs to 100 µs<br>2 mV (max)<br><0.5 V with a ±700 mV, 2 ms pacemaker pulse applied |
| Lead fail | Identifies failed lead and switches to intact one |
| Analog output | Selectable @ 1 V/mV |
| Trends | 24 hours with 1-minute resolution |

| Table 2-7. Respiration Parameter for All Modules | |
|---|---|
| **Item** | **Description** |
| Rate range | 1 to 200 breaths/minute |
| Impedance range | 100 to 1000 ohms at ±52.6 kHz |
| Detection sensitivity range | 0.4 to 10 ohms impedance variation |
| Low rate alarm range | 1 to 199 breaths/min |
| High rate alarm range | 2 to 200 breaths/minute |
| Apnea alarm rate | 0 to 30 seconds in one-second increments |
| Cardiac artifact alarm | |
| Waveform display bandwidth | 0.05 Hz to 2.5 Hz (–3 dB) |
| Analog output | Selectable |
| Trends | 24 hours with 1-minute resolution |

| Table 2-8. Invasive Blood Pressure Parameter for All Tram Modules Except Tram 800 and 850 Modules | |
|---|---|
| **Item** | **Description** |
| Catheter sites | Arterial, pulmonary arterial, central venous, left arterial, intracranial, right arterial, femoral arterial, umbilical venous, umbilical arterial, and special. |
| Accuracy | 2% ±1 mmHg (exclusive of transducer) |
| Measurement range<br>▪ Arterial<br>▪ All other sites | <br>–98 to 350 mmHg<br>–98 to 350 mmHg |
| Zero balance range | ±150 mmHg offset |
| Zero balance accuracy | ±1 mmHg |
| Transducer excitation | ±2.5 VDC |
| Transducer sensitivity | 50 µV/V/cmHg |
| Waveform frequency response | 0 Hz to 12 Hz or 0 Hz to 40 Hz (–3 dB) user-selectable |
| Analog output | Selectable, 1 V/100 mmHg |
| Trends | 24 hours with 1-minute resolution |

**Table 2-9. Temperature Parameter for All Tram Modules**

| Item | Description |
|---|---|
| Number of channels | 2 |
| Probe type | YSI Series 400 or 700 |
| Range | 0˚C to 45˚C (32°F to 113°F) |
| Gain | 121.95 ±1% |
| Linearity | <1% from 30˚C to 42˚C |
| DC drift | <1 mV/˚C |
| Error:<br>▪ YSI series 400 probes<br>▪ YSI series 700 probes | (Independent of source)<br>±0.1°C<br>±0.3°C |
| Noise | <20 mV from DC to 100 Hz |
| Alarms | User-selectable upper and lower limits for T1, T2 |
| Resolution | ±0.2°C |
| Displayed parameters | Temperature 1, Temperature 2 |
| Trends | 24 hours with 1-minute resolution |

**Table 2-10. Pulse Oximetry Parameter for All Tram Modules Except Tram 100 and 500 Modules**

| Item | Description |
|---|---|
| Saturation range | 0 to 100% |
| $SpO_2$ Accuracy<br>■ 90% to 100%<br>■ 80% to 89.9%<br>■ 60% to 100%<br>■ Below 60% | <br>1.5%<br>2.1%<br>2.4% (overall range)<br>Unspecified |
| Pulse rate range | 40 to 235 beats/minute |
| Pulse rate accuracy | ±1.7% of current reading (assumes constant pulse rate) |
| Displayed frequency response | 1.5 to 10.5 Hz |
| Alarm limit range<br>■ $SpO_2$<br>■ Pulse | <br>1% to 105%<br>40 to 235 beats/min |
| Displayed parameters | Oxygen saturation, pulse rate |
| Trends | 24 hours with 1-minute resolution |
| Analog output | Selectable waveform |
| Analog output | Selectable saturation 0 to 100% equivalent 0 to 1 V |
| Messages sent to display | Interference Detected, Low Light, Check Probe, Low Signal Quality, Probe Off Patient, Replace Bad Probe, Service the Module |

| Table 2-11. Non-Invasive Blood Pressure Parameter for All Tram Modules Except Tram 500, 600, and 650 Modules | |
|---|---|
| **Item** | **Description** |
| Measurement technique | Oscillometric |
| Displayed parameters | Systolic, diastolic, and mean pressures; time of last measurement, cuff size, countdown to next measurement |
| Cuff inflation rate | 25 mmHg/sec (nominal) |
| Cycle time | Typically 20 to 40 sec (dependent on heart rate) |
| Maximum inflation pressure | |
| ■ Adult | 300 mmHg |
| ■ Neonatal | 150 mmHg |
| Heart rate detection | 30 to 300 beats/minute |
| Measurement modes | Manual, auto, and stat. Stat mode is 5 minutes of continuous measurements. |
| Trends | 96 stored events saved a maximum of 24 hours |
| Cuff sizes: | |
| ■ Disposable | Large adult (33 cm to 47 cm), adult (25 cm to 35 cm), small adult (18 cm to 26 cm), small pediatric (6 cm to 17 cm), infant (5 cm to 15 cm) and neonates (3 cm to 6 cm, 4 cm to 8 cm, 6 cm to 11 cm, 7 cm to 13 cm, and 8 cm to 15 cm) |
| ■ Reusable | Thigh (46 cm to 66 cm), large adult (33 cm to 47 cm), adult (25 cm to 35 cm), child (18 cm to 26 cm), infant (10 cm to 19 cm) and newborn* (6 cm to 11 cm)<br>*Requires pn 9461-205 neonatal tubing |

| Table 2-12. Cardiac Output Parameter for All Tram Modules | |
|---|---|
| **Item** | **Description** |
| Cardiac output range | 0.2 to 15 liters/min |
| Blood temperature range | 30°C to 42°C (86°F to 107°F) |
| Injectate temperature range | 0°C to 30°C (32°F to 86°F) |
| Waveform display frequency response | 0 Hz to 10 Hz (–3dB) |
| Displayed parameters | Cardiac output, blood temperature, injectate temperature, trial number |
| Injectate volume | 3, 5, or 10 cc |

**Table 2-13. Certification for All Tram Modules**

| Item | Description |
|---|---|
| Safety limits and performance standards | Meets the requirements of ANSI/AAMI ES1 |
| Safety standards | UL 544 listed<br>CSA No. 125 certified<br>IEC 601-1 certified |

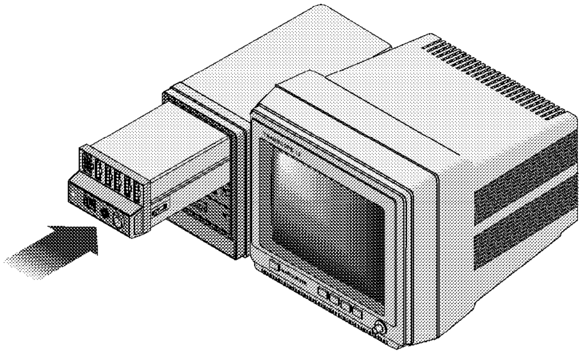
**Table 2-14. Classification for All Tram Modules**

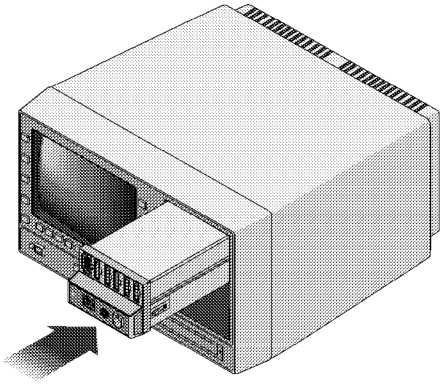
| Item | Description |
|---|---|
| Type of protection against electrical shock | Not applicable |
| Degree of protection against electrical shock | Type CF equipment |
| Degree of protection against harmful ingress of water | Ordinary Equipment (enclosed equipment without protection against ingress of water) |
| Degree of safety of application in the presence of a flammable anesthetic moisture with air or with oxygen or nitrous oxide | Equipment not suitable for using the presence of a flammable anesthetic moisture with air or with oxygen or nitrous oxide. |
| Method(s) of sterilization or disinfection recommended by the manufacturer | Not applicable |
| Mode of operation | Continuous operation |

# Power Up

## Insert Module

Insert the module in the top slot of a Tram-rac 4 housing or Series 70XX-type.





1. Connect appropriate parameter cables
2. Apply power to the monitor. If your Tram-rac housing has its own power supply, apply power to it, too.
3. Ensure POWER indicator on the Tram module's front panel is turned ON.

## Identification

After inserting the module, the module should also identify itself on the monitor screen with a patient parameter box.

If the module does not identify itself on the screen, refer to "Troubleshooting Procedure" in Chapter 5: "Troubleshooting."

## Preparation for Use

Perform the following procedures, before presenting the module for service.

- Perform the "Checkout Procedure" provided in Chapter 4: "Preventive Maintenance."
- If the module fails any tests, refer to "Troubleshooting Procedure" in Chapter 5: "Troubleshooting."

*For your notes*

# 3 TROUBLESHOOTING

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# General Fault Isolation

## First Things to Ask

If the unit is not working properly, save yourself some time troubleshooting by asking yourself these basic questions.

- Is the module seated correctly?
- Is the monitor and/or Tram-rac housing power cord connected?
- Is the monitor turned ON at the rear of the monitor?
- Is the display LED illuminated? Are all the communication cables firmly connected?
- Were there any changes in the use, location, or environment of the equipment that could cause the failure?
- Has the unit been modified in any way, either in software or hardware?

Is operator error the cause of the problem? Try to repeat the user's scenario exactly and compare that to the proper operation of the equipment. Check the operator's manual as necessary.

## Visual Inspection

A thorough visual inspection of the equipment can save time. Small things—disconnected cables, foreign debris on circuit boards, missing hardware, loose components—can frequently cause symptoms and equipment failures that may appear to be unrelated and difficult to track.

Take the time to make all the recommended visual checks (refer to the visual inspection chart on the next page) before starting any detailed troubleshooting procedures.

## Calibration

There is very little calibration required for the input modules. If a parameter does not pass the checkout procedure provided in Chapter 3: "Preventive Maintenance," refer to the individual circuit board chapters in this manual for any PCB level calibration. In most cases, the modules should be returned to the factory for service.

**Table 3-1. Visual Inspection List**

| Area | Look for the following problems: |
|---|---|
| I/O Connectors and Cables | ■ Fraying or other damage<br>■ Bent prongs or pins<br>■ Cracked housing<br>■ Loose screws in plugs |
| Interface Cables | ■ Excessive tension or wear<br>■ Loose connection<br>■ Strain reliefs out of place |
| Circuit Boards | ■ Moisture, dust, or debris (top and bottom)<br>■ Loose or missing components<br>■ Burn damage or smell of over-heated components<br>■ Socketed components not firmly seated<br>■ Solder problems: cracks, splashes on board, incomplete feedthrough, prior modifications or repairs |
| Ground Wires/Wiring | ■ Loose wires<br>■ Faulty wiring<br>■ Wires pinched or in vulnerable position |
| Mounting Hardware | ■ Loose or missing screws or other hardware |
| Power Source | ■ Faulty connection between PCBs<br>■ Power source problems may cause static discharge, resetting problems, and noise. |

**WARNING**
Solder multilayer and surface mount PCB assemblies at your own risk! Improper repair methods can damage the PCB assemblies even further. Only qualified service personnel with the proper laboratory equipment should attempt to repair PCB assemblies.

# Considerations for Special Components

## CMOS Components

This equipment contains many CMOS components, which are less susceptible to noise and consume less power than standard TTL or NMOS components. However, CMOS components are more easily damaged by electrostatic discharge (ESD) than other semiconductors.

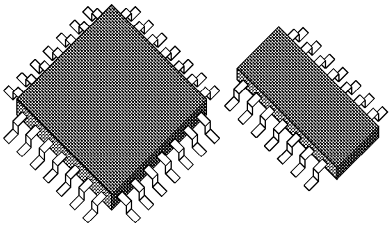
ESD damage, usually a subtle weakening of semiconductor junctions, can range from corruption of digital memory to catastrophic system failure. Although CMOS components most frequently fail from ESD damage, no semiconductor device is completely safe from ESD damage.

The inputs and outputs of all the equipment components are protected from ESD damage during normal operation. However, during servicing, these components are exposed to several sources of static electricity, ranging from human hands to improperly grounded test equipment. For this reason, all service workstations should be as static-free as possible.

The following guidelines can help reduce ESD damage to semiconductors and assemblies with semiconductors.

- Discharge any static charge you may have built up before handling static-sensitive devices.
- Wear a grounded, anti-static wristband or heel strap.
- Use only properly grounded soldering and test equipment.
- Use a static-free surface.
- Store semiconductors and static-sensitive assemblies in an anti-static container until needed.
- Always turn off the power before removing or inserting a semiconductor.
- Do not slide semiconductors or assemblies containing semiconductors across any surface.
- Do not touch semiconductor leads unless absolutely necessary.

## Surface Mounted Components



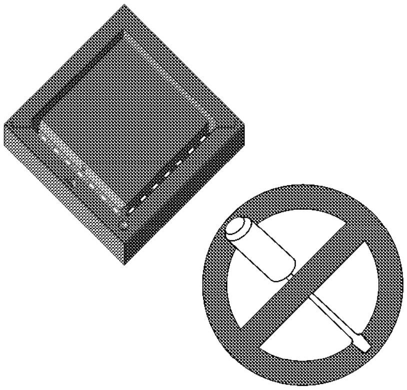
Surface mounted components are used to aid in miniaturizing the Tram 100-850 A and SL modules.

Surface mounted integrated circuits have legs that are soldered to rectangular pads on the surface of the circuit board, rather than having legs that are made to be inserted into holes that go through the circuit board. Surface mounted integrated circuits can have legs on either two or four sides of the chip.

Surface mounted resistors, capacitors, and diodes usually have no legs at all – conductive parts of their bodies are soldered directly to the circuit board.

**CAUTION**
Surface mounted components were not designed to be removed and replaced with standard soldering equipment. Removing a surface mounted component with a conventional soldering iron could destroy the circuit board. Special equipment is required to remove and replace these items.

## Plastic Leaded Chip Carriers



Plastic leaded chip carriers (PLCCs) are also used in the Tram 100-850 A and SL modules to aid in miniaturizing the equipment.

They are integrated circuits that have “loops” on four sides that make contact with a socket or they are soldered directly to the PCB.

**CAUTION**
PLCCs require special care, and some special tools when they are removed. If you attempt to remove a PLCC from its socket with a screwdriver, you are likely to damage both the PLCC and its socket. A Burndy QILEXT-1 or equivalent extractor must be used to remove a PLCC from its socket.

## Flex Circuits

The Tram modules use flex circuits to route signals between pcb assemblies. Flex circuits are intended to flex very small amounts. If you force them to flex very far out of their normal range of motion, they will fail. Take extreme care not to disturb flex circuits more than is absolutely necessary when you service the Tram module, especially when removing and replacing circuit boards that are connected with flex circuits.

# Troubleshooting Procedure

To use this troubleshooting procedure, read through the steps in the table until you find a similar problem to the one you are having. Do not perform any invasive procedures listed in this procedures unless you are a trained field or bio-medical engineer.

**WARNING**
This procedure is intended for use by service personnel with advanced troubleshooting skills. The consequences of the following steps may cause loss of patient data and disruption of the entire Marquette Unity Network.

**Table 3-2. Troubleshooting Chart**

| | |
|---|---|
| **Does the power indicator turn on?**<br>Yes No | This problem has may sources, so try one or more of the following solutions. |
| | 1. If the power indicator fails to turn on, and the monitor has no communications with the Tram module, it means that power isn't making it all the way from the monitor to the module processor PCB.<br>2. Verify monitor is functional.<br>Most of the time, a failure of this sort is caused by a faulty power supply PCB, pn 401309-002. Try swapping the one in your module with a known-good one. |

**Table 3-2. Troubleshooting Chart**

| | |
|---|---|
| **Does the diagnostic indicator turn on?**<br>Yes No | The Tram module has one diagnostic indicator: dual-color light-emitting diode DS1, located on the bottom of the module processor PCB, pn 800210-00x. It is referred to as the "I AM OK" light.<br>Follow these steps to view the indicator in action. |
| | 1. Remove the module cover (item 1 in the exploded views listed in chapters 7 through 16).<br>2. Turn the Tram module upside-down.<br>3. Apply power to the Tram module. The easiest way to do this is to connect a Smart-pac-equipped transport display to the front panel connector of the Tram module, but a better way is to use an extender board to connect it to a monitor. |
| | You can see the diagnostic indicator between the power supply PCB and the bottom chassis ground plate. Watch it while you apply power. If the Tram module is "healthy", it:<br>■ glows red until the communication controller on the module processor gets up and running,<br>■ flashes between green and red a couple of times while the main microprocessor on the module processor PCB boots, and then<br>■ steadily glows green until external power is removed. |
| | If the module runs into trouble, it's likely that one of the following is true.<br>■ The diagnostic indicator *never flashes* at all when the power is applied. Try replacing the module processor PCB.<br>■ The diagnostic indicator *stays steady red.* Sometimes the pulse oximetry PCB causes this condition. Try disconnecting it and powering the module again. If that doesn't do it, try replacing the module processor PCB.<br>■ The diagnostic indicator *stays flashing red/green.* |
| **Does the fan turn on?**<br>Yes No | When you insert the module into a monitor, it tries to establish communications with the monitor. The next step, when the module's sure that it is in a monitor, and not just connected to a transport display, is to turn on its fan.<br>If the diagnostic indicator continues to flash between red and green and:<br>■ the fan doesn't turn on, then the problem is probably with the module processor pcb, pn 800210-00x; or<br>■ the fan does turn on, then the problem is in the data acquisition module.<br>Try replacing the offending assembly. |

**Table 3-2. Troubleshooting Chart**

| | |
|---|---|
| **Does the Tram Module communicate with the monitor or display?**<br>Yes ↓ No → | If the Tram module is inserted in a monitor, try viewing the software revisions at the monitor. The Tram module software revision should be among the revisions listed. If it isn't, the Tram module isn't communicating with the monitor.<br>When the Tram module doesn't communicate with a transport display, the transport display shows a COMMUNICATION FAILURE message.<br>1. If the Tram module communicates with a monitor, but not a transport display,<br>▪ make sure the Tram module is plugged into the connector at the rear of the transport display (it's not supposed to work in the one on the side of the transport display),<br>▪ if it's connected to the correct connector, suspect the non-isolated input PCB, pn 401315-002, or the flex circuit that connects it to the module processor PCB. Try testing continuity on the flex circuit or swapping the assemblies.<br>▪ if that doesn't work, try swapping the module processor PCB, pn 800210-00x.<br>2. If the Tram module communicates with a transport display, but not a monitor:<br>▪ first, try replacing the power supply PCB, pn 401309-002, then,<br>▪ try swapping the module processor PCB, pn 800210-00x, with a known-good one.<br>3. If the Tram module doesn't communicate with either the transport display or the monitor, suspect the module processor PCB, pn 800210-00x. |
| **End** | This is the extent of the troubleshooting steps developed at this time. |

# Service Messages

Service messages are usually located in the upper left corner of the screen on the transport display when they are active. The exception to this rule is "BATTERY FAIL", which is located in the center of the screen on the transport display when it is active.

The following is a list of the possible service messages that can be encountered when using a transport display with one of the Tram modules, and what they mean.

**Table 3-3. List of Service Messages**

| Message | Description |
|---|---|
| **CALL SERVICE 25** | Bus error occurred. |
| **CALL SERVICE XX** | Task Stack Overflow Error.<br>■ If XX<25, then XX is the number of a Tram module task for the stack overflow.<br>■ If XX≥50, then XX-49 is the number of a transport display task for the stack overflow. |
| **CALL SERVICE 201** | 68000 microprocessor diagnostics failure. |
| **CALL SERVICE 202** | Tram module ROM checksum error during start-up. |
| **CALL SERVICE 203** | Tram module ROM checksum error during operation. |
| **CALL SERVICE 204** | Tram module RAM read/write test failure after hot start. |
| **CALL SERVICE 205** | Tram module RAM read/write test failure after cold start. |
| **CALL SERVICE 206** | Tram module RAM read/write test failure during operation. |
| **CALL SERVICE 208** | Tram module RAM battery voltage low.<br>Replace battery BT1 on the module processor PCB, pn 800210-00x. |
| **EVALUATION ONLY** | Tram module software is an unreleased version. |
| **LOW BATTERY** | Battery capacity is under 20%. |
| **BATTERY POWERED** | The Tram module is running on battery power. |
| **BATTERY FAIL** | Smart-pac battery pack failure. This error is usually caused by one of these conditions:<br>■ Battery pack cell reversal detected<br>■ Battery pack cell over-temperature detected during charging<br>■ Battery pack voltage is less than 10 volts<br>■ Smart-pac battery backpack lost communication with batteries.<br>■ Try charging the Smart-pac battery pack in a Smart-pac charger. |

# Theory of Operation

## Overall Theory

Overall theory of operation is described in the following paragraphs. Detailed theory of operation for the module processor PCB is described last.

Refer to the top level block diagram and interconnect signals in the top level assembly chapters presented later in this manual for the specific promontories described below represented in your Tram module.

### DAS Module

Each Tram module contains a DAS (data acquisition) module that collects patient data for those parameters that require their electrodes, transducers, and sensors to be isolated from ground for the safety of the patient. These parameters include ECG, pressure, and temperature or cardiac output. The DAS module sends the patient data to the module processor PCB and any other devices on the Tram-net network that require real-time patient data. The DAS module also includes some of the NPB plumbing.

The DAS module contains two circuit boards:

- the isolated power supply PCB, pn 402329 (see Chapter 25), and
- the acquisition processor PCB, pn 800330/801040 (see Chapter 29).

### Acquisition Processor PCB

The acquisition processor PCB performs the data acquisition functions for the isolated inputs of the Tram module. This includes:

- conditioning all ECG, invasive blood pressure, temperature, and cardiac output signals from electrodes, transducers, sensors, and probes on the patient,
- converting those signals from analog signals to digital data, and
- sending the digital data across the Tram-net to the module processor PCB for further processing.

### Isolated Power Supply PCB

The isolated power supply PCB is located in the DAS module provides the acquisition processor PCB, pn 800330/801040, with power. Since the acquisition processor PCB has several direct connections with patient electrodes, transducers, etc., the power that it uses must be isolated from ground to protect the patient from potentially hazardous current leakage during defibrillation and electrosurgery. As a result, every voltage produced by this PCB is isolated from earth ground.

### Power Supply PCB

The power supply PCB performs all power conversions in the Tram and supplies all of the other PCBs with the correct voltage levels. The exception to this is the acquisition processor PCB, which is powered by the isolated power supply PCB. The power supply PCB also serves as a path for signals between the module processor PCB, pn 800210, and the monitor.

## Non-Isolated Input PCB

The non-isolated input PCB is a passive circuit board that passes signals between the module processor PCB, pn 800210, and the connectors for the transport display and analog output.

## Power Indicator PCB

The power indicator PCB, pn 403170-009, is a passive circuit board that illuminates the power LED. The power indicator PCB, pn 403170-011, also passes signals between the pulse oximetry PCB and the SpO2 probe connector on the front panel of the Tram module.

PN 403170-009 is used in the Tram 100A/500A modules.

PN 403170-011 is used in the Tram 250SL, 450SL, 650SL, and 850A/SL modules.

Both the power indicator PCB, pn 403170-008, and the interconnect PCB, pn 800006-001, are used in the Tram 200A/SL, 400A/SL, 600A/SL, and 800A/SL modules. The interconnect PCB is a passive circuit board that simply passes signals between the Ohmeda pulse oximetry PCB and the power indicator PCB.

## Fan PCB

The fan PCB regulates the power going to the fan. It also serves as a signal path between the module processor PCB and the NBP valve assembly.

## NBP Valve Assembly

The NBP valve assembly is used in the Tram 100A, 200A/SL, 250SL,400A/SL, 450SL, 800A/SL, and 850A/SL modules. The NBP valve assembly contains the pressure release valves that regulates the air pressure in the non-invasive blood pressure cuff.

PN 413021-001 replaced pn 404459-001 in most Tram assemblies.

## NBP PCB

This PCB interfaces the pump and solenoid valves in the noninvasive blood pressure assembly with the module processor PCB. This includes buffering pump and solenoid control signals from the module processor PCB, and returning NBP status information to the module processor PCB. Note that all signals between the NBP PCB and the module processor PCB travel across the fan PCB.

## Pulse Oximetry PCB

The pulse oximetry PCB acquires arterial oxygen saturation and peripheral pulse rate data using the $SpO_2$ probe.

For Tram 250, 450, 650, and 850 modules, circuit board, pn 800674-001, supports MEI and Nellcor $SpO_2$ probes and is produced by Marquette Electronics, Inc. The encasing housing assembly for the circuit board is pn 414409-001.

For Tram 200, 400, 600, and 800 modules, circuit board, pn 41189-001, supports Ohmeda probes and is produced by Ohmeda. Ohmeda supports this PCB with an *Ohmeda MINX Module Interface Manual.* The manual includes schematic diagrams, theory of operation, and troubleshooting to the component level.

For service information about the Ohmeda circuit board, the manual, pn 1128-304, is only available directly from the following address.

Ohmeda
1315 West Century Drive
Louisville, CO 80027
Phone:(303) 666-7001
(800) 652-2469
Fax:(303) 665-9231
Telex:296 445 BTI UR

For more details about the interconnect PCB between the Ohmeda circuit board and the power indicator circuit board, refer to chapter 25.

## Module Processor PCB

### Versions

There are three different versions of the module processor PCB:

- PN 800210-001 was used first in all of the A-series modules; and
- PN 800210-002 was introduced in the SL-series modules, and then added to the A-series modules; and
- PN 800210-005 replaced both of the first two versions.

**NOTE**
You may replace either version -001 or -002 board with a -005 board, but do not replace a -005 with a -001 or -002 circuit board.

### Overview

The module processor PCB performs most of the data processing in the Tram module. It contains two microprocessors and the support hardware necessary to run them. It collects patient data from the acquisition processor and pulse oximetry pcb assemblies, processes that data, and formats the data for a Series 70XX monitor, Tramscope monitor, Solar monitor, or a transport display. The data then passes through the power supply PCB, pn 401309, on its way to a monitor, or through the non-isolated input PCB, pn 401315, on its way to a transport display.

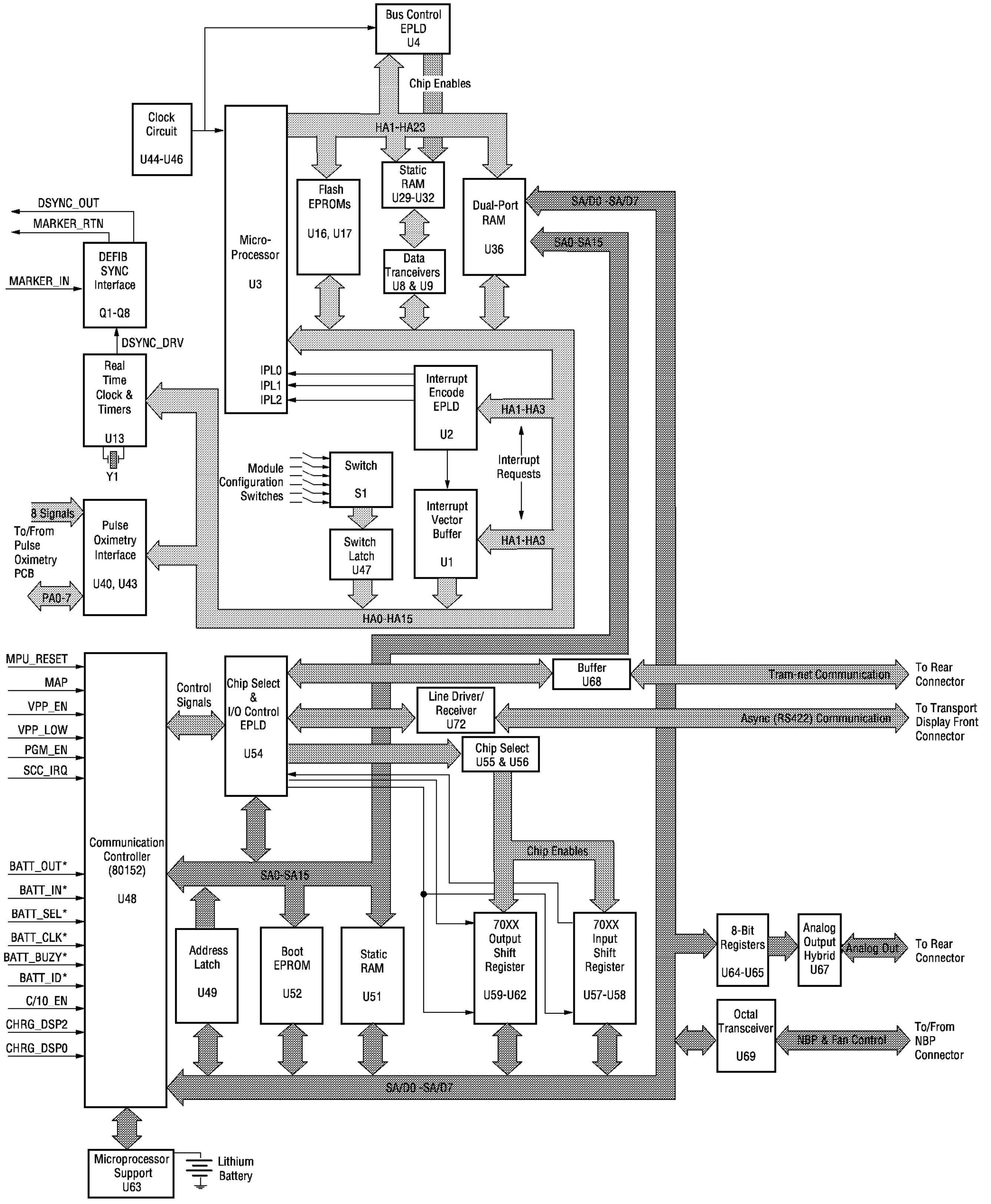
The module processor PCB is a dual processor design consisting of a main microprocessor U3 and communication controller U48. Both processors operate at a frequency of 14.7456-MHz. The dual processor approach frees the main microprocessor from performing low level tasks such as A/D converter control and UART servicing, allowing the available main microprocessor time to be used for digital filtering, arrhythmia analysis, and other algorithmic processing. Communications, analog outputs, and most other I/O tasks are handled by the communication controller. Patient waveform data is acquired by the acquisition processor PCB which contains its' own processor.

Operating code for the TRAM module is stored in electrically erasable flash EPROM memory U16 and U17 and downloaded at each power- up from the main microprocessor to the other processors in the module. Code may be updated electrically via communication with a PC directly to the front connector.

### Main Microprocessor

The main microprocessor U3 functions as the host CPU. It controls and coordinates the activities of the other processors in the module. The main microprocessor accesses fairly large amounts of program and data storage memory (for an embedded system). On power up, it downloads operating code to both the communication controller and the acquisition processor on the acquisition processor PCB via an internal synchronous serial link. Communication with the communication controller is handled by dual-port RAM U36 which provides asynchronous access to the shared static RAM array U29-U32, except for the case in which both processors attempt to access the same address and one is performing a write operation.

**Given below is the overall block diagram for the module processor PCB. Details are discussed in the following paragraphs.**


Bus Control EPLD U4
Chip Enables
Clock Circuit U44-U46
HA1-HA23
Micro-Processor U3
IPL0
IPL1
IPL2
Flash EPROMs U16, U17
Static RAM U29-U32
Data Tranceivers U8 & U9
Dual-Port RAM U36
SA/D0 -SA/D7
SA0-SA15
DSYNC_OUT
MARKER_RTN
MARKER_IN
DEFIB SYNC Interface Q1-Q8
DSYNC_DRV
Real Time Clock & Timers U13
Y1
Interrupt Encode EPLD U2
HA1-HA3
Interrupt Requests
Module Configuration Switches
Switch S1
Switch Latch U47
Interrupt Vector Buffer U1
HA1-HA3
8 Signals
To/From Pulse Oximetry PCB
Pulse Oximetry Interface U40, U43
PA0-7
HA0-HA15
MPU_RESET
MAP
VPP_EN
VPP_LOW
PGM_EN
SCC_IRQ
Control Signals
Chip Select & I/O Control EPLD U54
Buffer U68
Tram-net Communication
To Rear Connector
Line Driver/ Receiver U72
Async (RS422) Communication
To Transport Display Front Connector
Chip Select U55 & U56
Chip Enables
Communication Controller (80152) U48
BATT_OUT*
BATT_IN*
BATT_SEL*
BATT_CLK*
BATT_BUZY*
BATT_ID*
C/10_EN
CHRG_DSP2
CHRG_DSP0
SA0-SA15
Address Latch U49
Boot EPROM U52
Static RAM U51
70XX Output Shift Register U59-U62
70XX Input Shift Register U57-U58
8-Bit Registers U64-U65
Analog Output Hybrid U67
Analog Out
To Rear Connector
Octal Transceiver U69
NBP & Fan Control
To/From NBP Connector
SA/D0 -SA/D7
Microprocessor Support U63
Lithium Battery

The following is a summary of the main microprocessor U3 hardware features:

- It operates at 14.7456-MHz and an external clock applied via pin 15. All logic requiring a synchronized clock is driven by the external clock source.
- 512K bytes of flash program memory U16-U17 (1 wait state) is electrically bulk erased and reprogrammed in system. 150nS access time parts operate at 1 wait state.
- 512K bytes CMOS battery-backed static (1 wait state). The entire static RAM array U29-U32 are continuously powered by a 3V 1AH lithium cell. 120 or 150nS chips run at 1 wait state.
- 8K bytes of dual port RAM U36 (zero wait state), is provided for high speed inter-processor communications.
- An interrupt encoder EPLD U2 is used as a dedicated five external interrupt handler. Three of the interrupts are edge-triggered types which are sampled and edge-detected by the EPLD. An 8-bit interrupt vector is output on the lower data bus by a decoder buffer U1 during a zero wait state IACK cycle (I acknowledge).
- Asynchronous bus control using EPLD U4 provides bus control logic for the main microprocessor. It generates chip selects, DTACK, and BUS ERROR signals using a buried or internal bus state counter. Chip selects are generated by decoding address lines A12 - A23.
- Battery-backed real-time-clock U13 provides time and date functions along with two general purpose multi-mode timers. The clock source for the timers is software selectable up to a maximum of 7.3728-MHz. The real-time-clock runs at 32.768-KHz using an on chip oscillator with external crystal Y1. A trim capacitor C2 provides the frequency fine-tuning required for accurate time keeping.
- The pulse oximetry function is implemented by a microprocessor based board either built by MEI or sourced by OHMEDA, called the MINX. It interfaces to the main microprocessor via one 8-bit input port, one 8-bit bidirectional port, and a number of handshake and control signals. In addition, the MINX generates two interrupts to the main microprocessor. The I/O ports appear as standard memory mapped devices with the handshake lines generated by hardware as the read and write cycles are run by the main microprocessor.

A 8-bit communication controller U48 functions as the serial communications and I/O processor. The communication controller retains the instruction set and on-chip peripherals timer/counters, UART, I/O ports, etc. In addition, it features a multi-protocol communication controller called the “Global Serial Channel,” two channels of DMA, and three more general purpose I/O ports (for a total of six ports).

## Communication Controller

Upon system power-up, the communication controller executes code stored in a 8K x 8 boot EPROM U52. Unlike the flash memory used for the main microprocessor, the boot code is permanent and may not be updated electrically. Initially the communication controller holds the main microprocessor in reset. When ready, it will allow the main microprocessor to come out of reset and the two will establish communications via the dual-port RAM U36. The main microprocessor then downloads operating code which the communication controller stores in static RAM U51 for execution. The normally separate program and data memory areas of the communication controller are combined into one block of 64K in static RAM U51, allowing the communication controller to execute code out of RAM.

The following is a summary of the I/O and system related functions handled by the communication controller U48:

- Controls enable signals for all other systems in the Tram. The idea here is to have one processor coordinate and control the status of the many subsystems in the Tram module. These include the main microprocessor reset, the acquisition power (and hence the acquisition processor reset), the MINX pulse oximetry board, the cooling fan, the NIBP module, and the flash memory programming controls. The hardware watchdog timer must also be serviced by the communication controller. Should the watchdog time-out, the microprocessor will be reset and the subsystems will be disabled.
- Implements the multi-protocol backplane digital interface. The Tram supports three different backplane interfaces including the 7010 synchronous shift register interface, asynchronous communications at 38.4K baud, and Tram-net synchronous network communications at 921.6K baud.
- Provides asynchronous communications with the TRAM LCD display at 38.4K baud via the front panel DISPLAY PORT. The communication controller contains an on-chip single channel UART which must be switched between the display port and the backplane.

**NOTE**
While the Tram supports asynchronous communications to both the display and the backplane, it cannot do so simultaneously. When used with low-end async-only Tramscope monitors, the Tram module cannot provide uninterrupted monitoring capability.

- Communicates with the data acquisition module synchronously at 921.6K baud either internally or over Tram-net communication. With Tram-net systems the acquisition data is actually sent onto the network and received back by the communication controller.

- The analog output hybrid U67 provides eight channels of analog output written to a 16-bit data/control port at a rate of 480-Hz. An internal DAC converts the port data to an analog voltage which is stored on a "hold" capacitor, buffered, and output.
- The Tram contains a small, low-noise cooling fan which is switched on as needed based on temperature information received from the acquisition processor. In the 7010 bedside monitor system, the fan will typically run continuously. In new Tram-rac systems, additional cooling should not be needed and the fan will remain off. Running the fan on an "as needed" basis minimizes the amount of dust, lint, etc. introduced into the module.
- The NBP module interface provides an 8-bit bidirectional port, two register select lines (buffered address lines), independent read and write strobes, an I/O chip select signal, and a master enable.
- The Tram module supports three different communications interfaces to/from its' backplane connector to make it compatible with both existing Series 70XX-type monitors and Tram Critical Care systems. These include the following:
  - Series 70XX synchronous shift register interface
  - Tram-net synchronous communication at 921.6K baud
  - Asynchronous communication at 38.4K baud

Block diagrams for each are presented on the next page. Tram-net systems require a carrier detect signal which is driven low as long as data transmissions are detected on the network. Carrier detect is driven high 1-1/2 bit times after the last edge is detected. In addition, if the acquisition processor and the communication controller were to transmit Tram-net data simultaneously (i.e. collide, as indicated by an overlap of each processors' driver enable signal), a special 'collision presence' waveform must be output to allow all network users to detect the collision. Buried logic on the chip select EPLD U56 handles these functions.

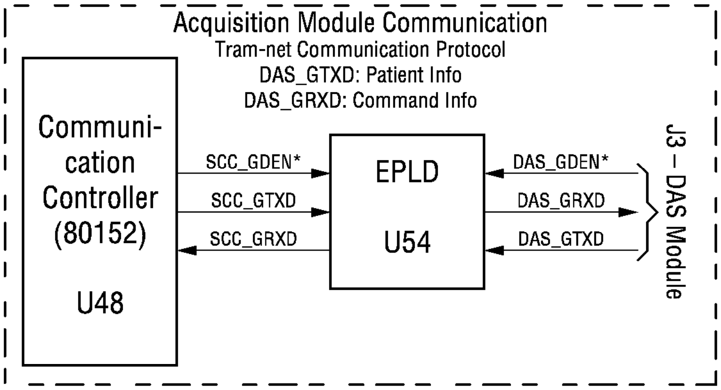
Memory and I/O device chip selects are also generated by the chip select EPLD. The fifteen device chip selects are output as four encoded chip selects (ECS0, ECS1, ECS2, and ECS3) which are expanded externally by a decoder chip select device U55.

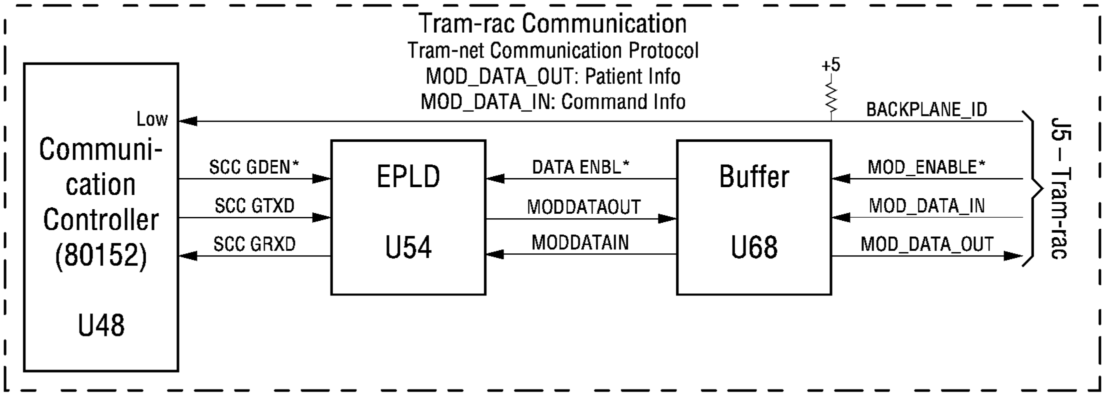
## DEFIB SYNC Interface

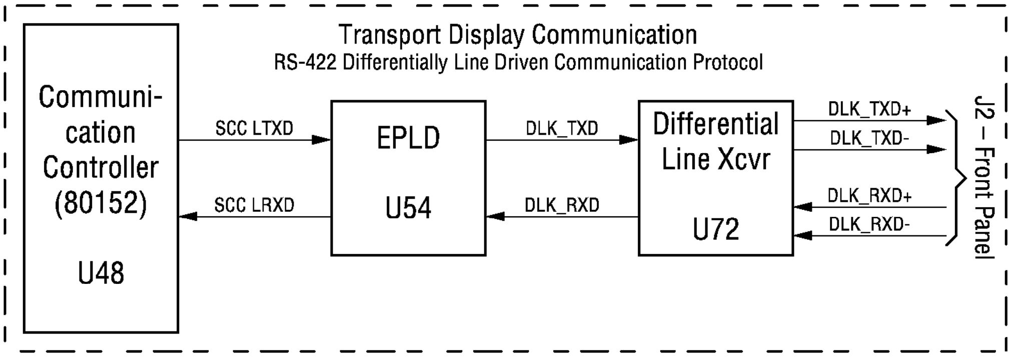
The DEFIB SYNC interface will detect QRS and output trigger pulse on pin 3 of the 6-pin circular connector labeled DEFIB SYNC. A Marquette defibrillator will return the same pulse on pin 4 if it is powered up and SYNC MODE is selected. The monitor then displays a marker pulse on the screen. Both signals are referenced to pin 2 (DGND). The defibrillator will fire when the SHOCK key(s) are pressed and the sync pulse arrives at the TRIGGER IN input.

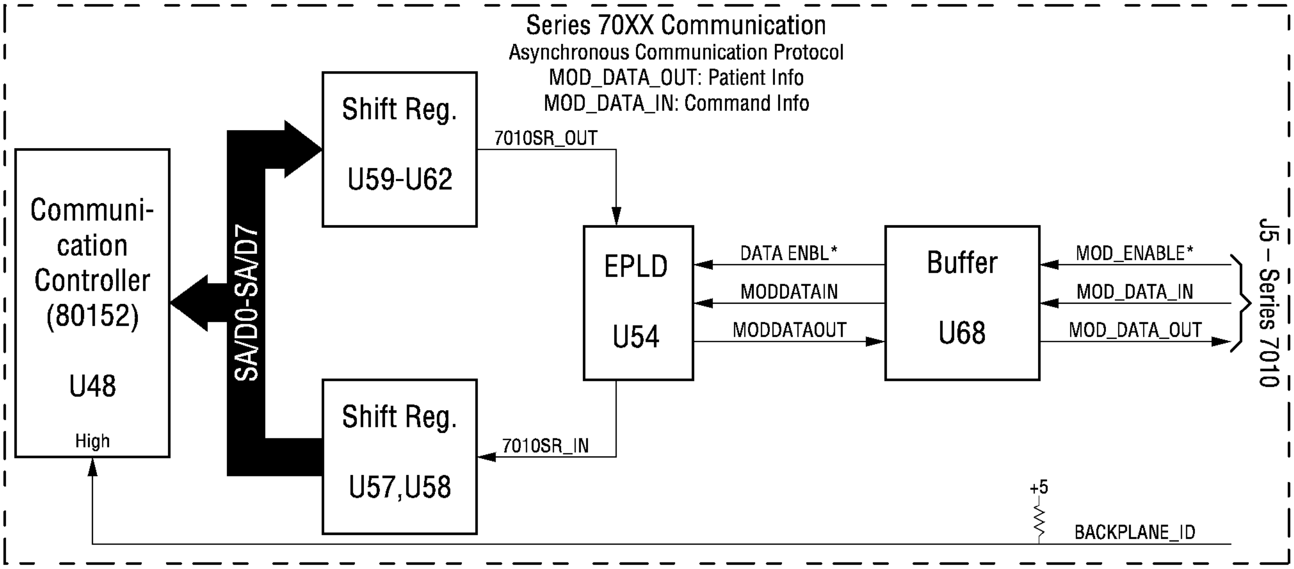
SYNC MODE can be selected on the defibrillator only if it is connected to the Tram module and both units are powered up. The Tram SYNC OUT is open circuit when not powered to allow the defibrillator to detect the power OFF condition.

The following block diagrams represent the different types of communication provided by the module processor PCB.


Acquisition Module Communication
Tram-net Communication Protocol
DAS_GTXD: Patient Info
DAS_GRXD: Command Info
Communi-cation Controller (80152) U48
SCC_GDEN*
SCC_GTXD
SCC_GRXD
EPLD U54
DAS_GDEN*
DAS_GRXD
DAS_GTXD
J3 – DAS Module


Tram-rac Communication
Tram-net Communication Protocol
MOD_DATA_OUT: Patient Info
MOD_DATA_IN: Command Info
+5
BACKPLANE_ID
Low
Communi-cation Controller (80152) U48
SCC GDEN*
SCC GTXD
SCC GRXD
EPLD U54
DATA ENBL*
MODDATAOUT
MODDATAIN
Buffer U68
MOD_ENABLE*
MOD_DATA_IN
MOD_DATA_OUT
J5 – Tram-rac


Transport Display Communication
RS-422 Differentially Line Driven Communication Protocol
Communi-cation Controller (80152) U48
SCC LTXD
SCC LRXD
EPLD U54
DLK_TXD
DLK_RXD
Differential Line Xcvr U72
DLK_TXD+
DLK_TXD-
DLK_RXD+
DLK_RXD-
J2 – Front Panel


Series 70XX Communication
Asynchronous Communication Protocol
MOD_DATA_OUT: Patient Info
MOD_DATA_IN: Command Info
Communi-cation Controller (80152) U48
High
SA/D0-SA/D7
Shift Reg. U59-U62
7010SR_OUT
Shift Reg. U57,U58
7010SR_IN
EPLD U54
DATA ENBL*
MODDATAIN
MODDATAOUT
Buffer U68
MOD_ENABLE*
MOD_DATA_IN
MOD_DATA_OUT
J5 – Series 7010
+5
BACKPLANE_ID

# 4 CALIBRATION

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# Adjustments, Jumpers, and Switches

The following list summarizes Tram module's switches, jumpers, and adjustments. The following pages contain procedures, in much greater detail, for setting these items.

---

**NOTE**
Before starting any calibration procedure, refer to the "Considerations for Special Components," listed in Chapter 3: "Troubleshooting." This PCB uses many CMOS components, and when exposed to outside influences is highly susceptible to ESD damage.

---

Power Supply PCB, pn 401309

| | |
|---|---|
| R14 | Power supply clock frequency adjustment |

Isolated Power Supply PCB, pn 402329

| | |
|---|---|
| R1 | +5 ISO voltage adjustment |

Module Processor PCB, pn 800210

| | |
|---|---|
| W1 | Defib sync level jumper |
| W2 | Defib sync duration jumper |
| W3 | Battery disconnect jumper |
| S1 | Various software and hardware configuration switches |
| C2 | Real-time clock frequency adjustment |
| R64 | Battery low voltage trip point adjustment |

Acquisition Processor PCB, pn 800330

| | |
|---|---|
| R16 | Analog-to-digital converter offset adjustment |
| R17 | Analog-to-digital converter gain adjustment |

Acquisition Processor PCB, pn 801040

| | |
|---|---|
| R35 | Analog-to-digital converter offset adjustment |
| R37 | Analog-to-digital converter gain adjustment |

This chapter also includes non-invasive blood pressure (NBP) calibration procedures. These calibration procedures are performed through software, and do not require manual adjustments.

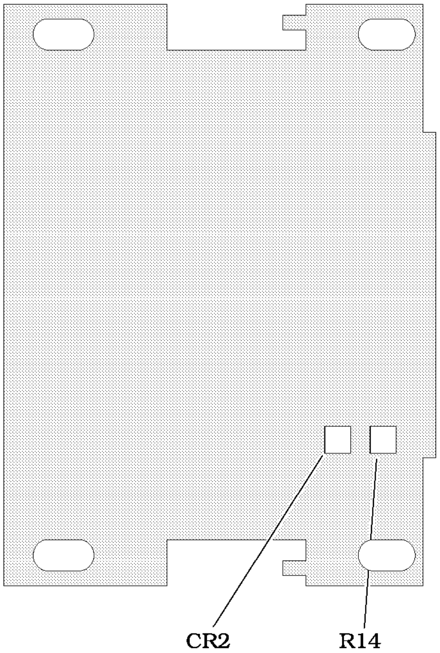
# Power Supply PN 401309

## Clock Frequency Calibration

The following procedure sets the frequency of the clock oscillator for the power supply. This procedure is only necessary when the power supply PCB has been repaired or replaced.

Before starting this procedure, refer to the "Considerations for Special Components," listed in Chapter 3: "Troubleshooting." This PCB is made almost entirely of CMOS components, and, when exposed to outside influences, is highly susceptible to ESD damage.

1. Expose the power supply PCB by removing the outside covers, shielding plates, etc. from the Tram module. Exploded views shown in chapters 7 through 16 will show the location of the circuit board, as well as the obstructions to the circuit board. You'll have to remove the four screws that secure the power supply PCB to the frame to access the adjustments.
2. Apply power to the Tram module. The easiest way to do this is to connect a Smart-pac Transport display to the front panel connector of the Tram module.
3. The pulse width modulator must be warmed up before continuing with the procedure. Wait at least two minutes before going to the next step.
4. Connect a frequency counter across diode CR2.
5. Adjust variable resistor R14 until the frequency counter reads 95.0 kHz (±1.0 kHz).



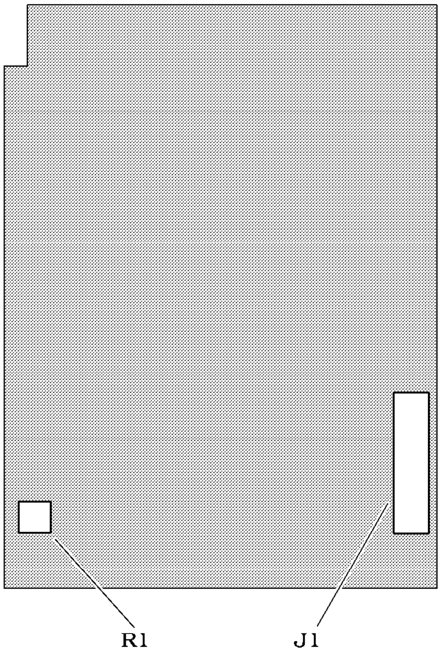
6. Seal the end of variable resistor R14 to prevent it from moving.
7. Remove power from the Tram module.
8. Reassemble the Tram module.

# Isolated Power Supply PCB PN 402329

## +5-Volt Isolated Output Calibration

The following procedure accurately sets the +5-volt isolated power output of the isolated power supply PCB. This procedure is only necessary when the isolated power supply PCB has been repaired or replaced.

Before starting this procedure, refer to the "Considerations for Special Components," listed in Chapter 3: "Troubleshooting." This PCB use many CMOS components, and, when exposed to outside influences is highly susceptible to ESD damage.



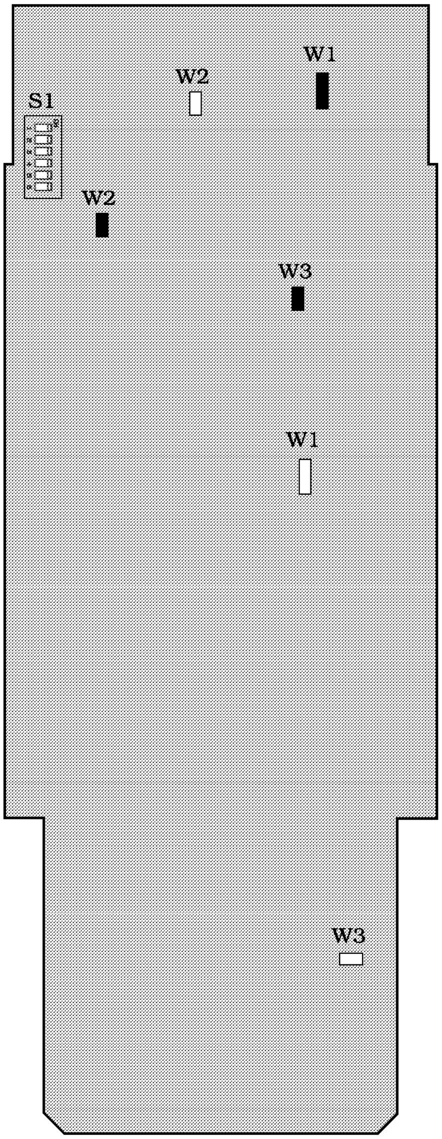
You'll need an extender cable so you can access the adjustments. To make the extender cable, you need two 2 x 8, 0.010-inch center connectors, pn 1783-016. You also need a pc header, pn 1778-916, and some wire. Wire the extender cable so that each pin on one connector is directly wired to the same pin on the other connector.

1. Expose the data acquisition module by removing the outside covers, shielding plates, etc. from the Tram module. Exploded views shown in chapters 7 through 16 will show the location of this assembly, as well as the obstructions to the assembly.
2. Remove the top cover of the data acquisition module to reveal the isolated power supply PCB.
3. Pull up on the power supply PCB to disconnect it from the acquisition PCB.
4. Connect the extender cable between connector J1 on the acquisition PCB and connector J1 on the isolated power supply PCB.
5. Apply power to the Tram module. The easiest way to do this is to connect a Smart-pac Transport display to the front panel connector of the Tram module.
6. Connect a volt meter across pins 6(–) and 7(+) of connector J1.
7. Adjust variable resistor R1 until the volt meter reads 5.00 V (±0.01 V).
8. Seal the end of variable resistor R1 to prevent it from moving.
9. Remove power from the Tram module.
10. Reassemble the Tram module.
11. Perform the current leakage and hi-pot tests listed in Chapter 5: "Preventive Maintenance."

# Module Processor PCB PN 800210

## Switches and Jumpers

This page and the next describe the functions of the switches and jumpers on the module processor PCB, pn 800210.



▮ Indicates position for PN 800210-005

▯ Indicates position for PN 800210-001/2

---

**NOTE**
The position of the jumpers depends on the version of the circuit board.

---

There are three jumpers on this circuit board as follows:

**W1** This jumper controls the output level of the defib sync pulse through the front panel connector. This jumper can be placed in one of two positions:

5V install a jumper in this location if the defibrillator used with the Tram module needs a 5-volt pulse, or

15V install a jumper in this location if the defibrillator used with the Tram module needs a 15-volt pulse.

This jumper is generally placed in the 5V position on new Tram modules.

**W2** This jumper controls the pulse width of the defib sync pulse:

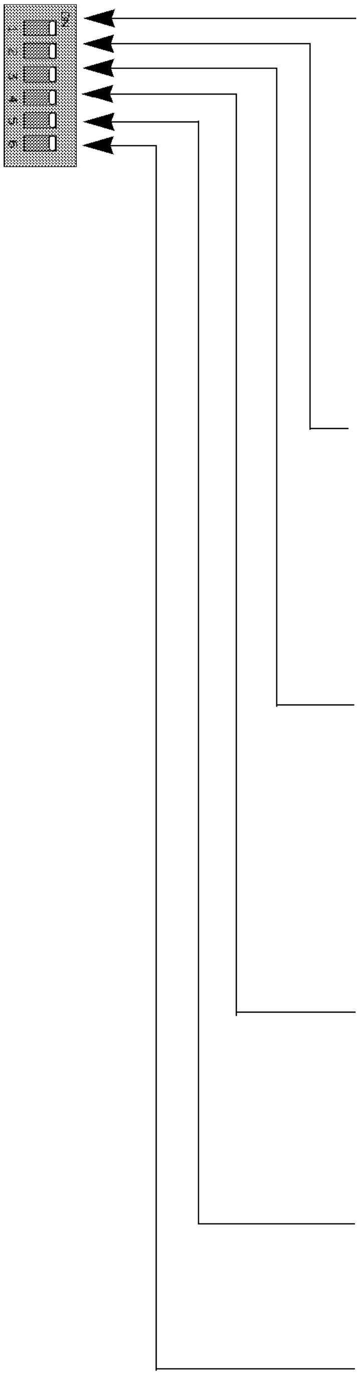
- install this jumper for a 100-millisecond pulse, or
- remove this jumper for a 10-millisecond pulse.

This jumper is generally not installed on new Tram modules.

**W3** This jumper is provided to allow battery BT1 to be removed from the circuit for calibration and testing. Jumper W3 must be in place for proper operation.

## Switches for Versions 001/002

Switch S1 is the only switch on the module processor PCB. This switch is a 6-station dip switch that is used to configure both hardware and software parameters. The following are the functions of each of the individual switch stations.



**SW1** 68000 Processor Clock Disable. The clock disable feature allows the 68000 microprocessor to be driven by an external clock source (typically an emulator) for development and service purposes. When the clock is disabled, an external clock must be applied to pin 15 of the 68000 microprocessor socket (U3). Note also that all logic on the module processor PCB that shares the clock signal with the 68000 microprocessor will also be driven by the external clock signal.

| | |
|---|---|
| ON | 68000 clock disabled |
| OFF | 68000 microprocessor clock enabled |

**SW2** 68000 Processor Clock Frequency. A half-speed clock may be selected for development and service testing where the test equipment (usually an emulator) is not capable of running at 14.7456 MHz, and an external clock is not available.

| | |
|---|---|
| ON | Clock speed = 7.3728 MHz |
| OFF | Clock speed = 14.7456 MHz |

**SW3** Enables or inhibits software updates and NBP calibration on all Tram modules.

| | |
|---|---|
| ON | Inhibit software updates and NBP calibration. During NBP calibration, when you select CAL GAIN from the menu, you'll be returned to the NBP CAL menu. You must turn this station off before proceeding. |
| OFF | Normal operation |

**SW4** Tram Integral Battery Option. The Tram 300 can be equipped with a Smaragdite battery pack. This switch enables that option.

| | |
|---|---|
| ON | Tram 300 |
| OFF | Tram 100, 200, 500, or 600 |

**SW5** Unit System Select

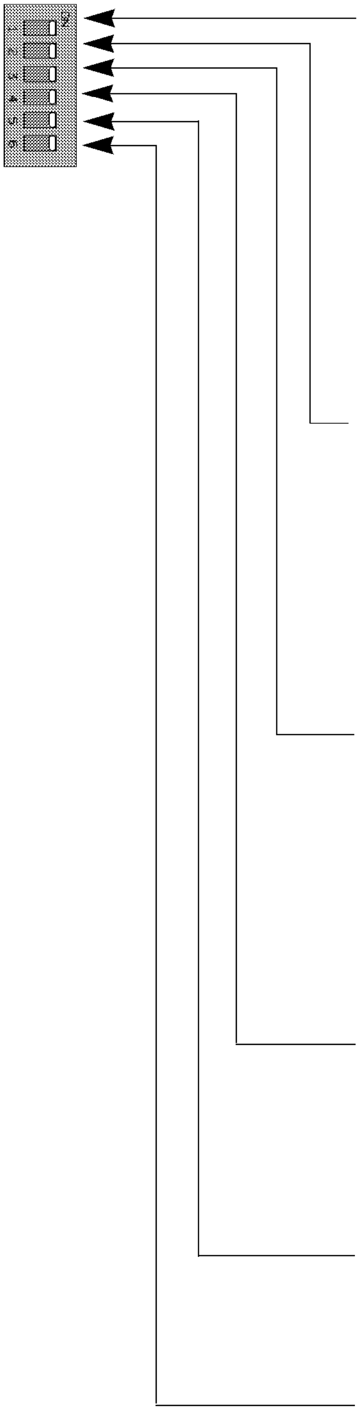
| | |
|---|---|
| ON | English Units |
| OFF | SI Units |

**SW6** Power Frequency Select.

| | |
|---|---|
| ON | 50 Hz |
| OFF | 60 Hz |

## Switches for Versions 005 Only

Switch S1 is the only switch on the module processor PCB. This switch is a 6-station dip switch that is used to configure both hardware and software parameters. The following are the functions of each of the individual switch stations.



**SW1** Not Used

**SW2** Not Used

**SW3** Enables or inhibits software updates and NBP calibration on all Tram modules.

ON Inhibit software updates and NBP calibration. During NBP calibration, when you select CAL GAIN from the menu, you'll be returned to the NBP CAL menu. You must turn this station off before proceeding.

OFF Normal operation

**SW4** Tram Integral Battery Option. The Tram 300 can be equipped with a Smartpac battery pack. This switch enables that option.

ON Tram 300

OFF Tram 100, 200, 500, or 600

**SW5** Unit System Select

ON English Units

OFF SI Units

**SW6** Power Frequency Select.

ON 50 Hz

OFF 60 Hz

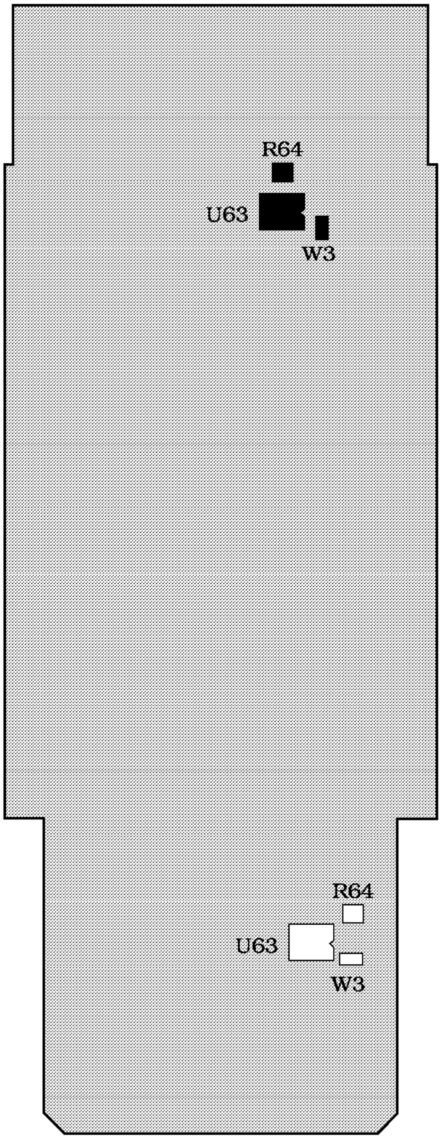
## Real-Time Clock Calibration

The real-time clock on the module processor PCB may not be calibrated in the field. Therefore, if you replace any components in the real-time clock circuit, you should return the module processor PCB to Marquette Electronics, Inc. for calibration. The real-time clock circuit consists of capacitors C1 and C2, real-time clock U13, and oscillator Y1.

## Battery Low Voltage Trip-Point Calibration

The module processor PCB contains battery-backed static RAM. The battery is a 3.0-volt battery, and is deemed too low to power the RAM when it has drained to the point where it only supplies 2.1 volts. This adjustment ensures that the Tram module will notify the transport display when the battery reaches the 2.1-volt level. The transport display then shows a service message on the display, CALL SERVICE 208, notifying the user that the battery should be changed.

This calibration should only be necessary when the module processor is removed and replaced.



▮ Indicates position for PN 800210-005

▯ Indicates position for PN 800210-001/2

**NOTE**
The position of the jumpers depends on the version of the circuit board.

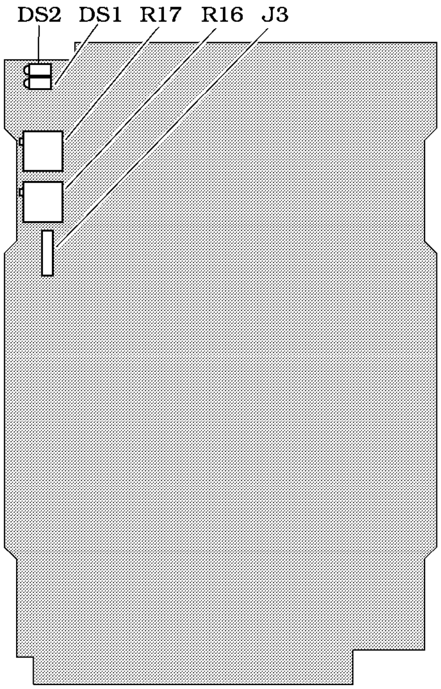
1. Remove jumper W3.
2. Turn variable resistor R64 fully clockwise. Some boards use a Murata Erie variable resistors for R64. These variable resistors have no positive mechanical stops, so you'll have to estimate full clockwise as best you can.
3. Apply an adjustable voltage source, set to 3.0 volts, to the W3 socket that is closest to the edge of the circuit board. The ground of the voltage source should be attached to a ground on the circuit board (pin 4 of U63 is a good one).
4. Verify pin 10 of U63 is a logic high.
5. Adjust the voltage source smoothly down to 2.1 volts. You must do this slowly and smoothly to avoid any undershoot.
6. Observe the logic level of pin 10 of U63 while slowly turning variable resistor R64 counter-clockwise. When the logic level of U63-10 goes low, stop turning.
7. Test this adjustment by ramping the power source from 3 volts to 2.1 volts again. Pin 10 of U63 should switch from a high to a low state at 2.1 volts ±50 millivolts.
8. Seal the end of variable resistor R64 to prevent it from moving.
9. Remove power from the Tram module.
10. Reassemble the Tram module.
11. Perform the Checkout Procedure, Current Leakage Tests, and Hi-Pot tests listed in Chapter 5: "Preventive Maintenance."

# Acquisition Processor PCB PN 800330

## Analog-to-Digital Converter Calibration

The following procedure accurately sets the zero offset and gain of the analog-to-digital converter on the acquisition processor PCB. This procedure is only necessary when the acquisition processor PCB has been repaired or replaced.

Before starting this procedure, refer to the "Considerations for Special Components," listed in Chapter 3: "Troubleshooting." This PCB uses many CMOS components, and when exposed to outside influences is highly susceptible to ESD damage.



1. Expose the data acquisition module by removing the outside covers, shielding plates, etc. from the Tram module. Exploded views shown in chapters 7 through 16 will show the location of this assembly, as well as the obstructions to the assembly.
2. Remove the top cover of the data acquisition module to reveal the acquisition processor PCB.
3. Apply power to the Tram module. The easiest way to do this is to connect a transport display with a battery pack to the front panel connector of the Tram module.
4. Jumper pins 2 and 3 of connector J3 together to enable the calibration mode. LEDs DS1 and DS2 will blink 5 times simultaneously to indicate the calibration mode is enabled.
5. Connect a low-noise, precision voltage source to the acquisition processor at pins 1 (+) and 4 (–) of connector J3. Set the voltage source to output –9.9976 volts.
6. If the offset adjustment of the analog-to-digital converter is inaccurate, either DS1 or DS2 will light.
   - If DS1 lights, rotate variable resistor R16 counter-clockwise until both lights are off.
   - If DS2 lights, rotate variable resistor R16 clockwise until both lights are off.

   Occasional blinking of the LEDs throughout the calibration procedure is normal. It doesn't necessarily mean that calibration is necessary again.

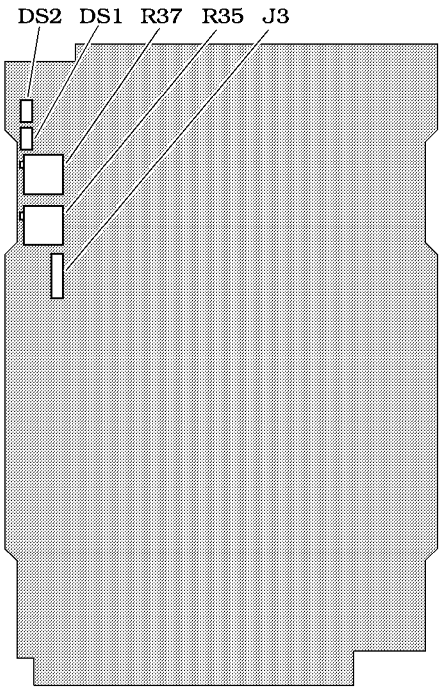
7. Adjust the voltage source to +9.9927 volts.
8. If the gain adjustment of the analog-to-digital converter is inaccurate, either DS1 or DS2 will light.
   - If DS1 lights, rotate variable resistor R17 counter-clockwise until both LEDs are off.
   - If DS2 lights, rotate variable resistor R17 clockwise until both LEDs are off.
9. Seal the end of variable resistors R16 and R17 to prevent them from moving.
10. Remove all power from the Tram module.
11. Remove the jumper from J3 and reassemble the Tram module.
12. Perform the Checkout Procedure, Current Leakage Tests, and Hi-Pot tests listed in Chapter 5: "Preventive Maintenance."

# Acquisition Processor PCB PN 801040

## Analog-to-Digital Converter Calibration

The following procedure accurately sets the zero offset and gain of the analog-to-digital converter on the acquisition processor PCB. This procedure is only necessary when the acquisition processor PCB has been repaired or replaced.

Before starting this procedure, refer to the Considerations for Special Components, listed in Chapter 3: Troubleshooting. This PCB uses many CMOS components, and when exposed to outside influences is highly susceptible to ESD damage.



1. Expose the data acquisition module by removing the outside covers, shielding plates, etc. from the Tram module. Exploded views shown in chapters 7 through 16 will show the location of this assembly, as well as the obstructions to the assembly.
2. Remove the top cover of the data acquisition module to reveal the acquisition processor PCB.
3. Apply power to the Tram module. The easiest way to do this is to connect a transport display with a battery pack to the front panel connector of the Tram module.
4. Jumper pins 2 and 3 of connector J3 together to enable the calibration mode. LEDs DS1 and DS2 will blink 5 times simultaneously to indicate the calibration mode is enabled.
5. Connect a low-noise, precision voltage source to the acquisition processor at pins 1 (+) and 4 (–) of connector J3. Set the voltage source to output –9.9976 volts.
6. If the offset adjustment of the analog-to-digital converter is inaccurate, either DS1 or DS2 will light.
    - If DS1 lights, rotate variable resistor R35 clockwise until both lights are off.
    - If DS2 lights, rotate variable resistor R35 counterclockwise until both lights are off.

   Occasional blinking of the LEDs throughout the calibration procedure is normal. It doesn't necessarily mean that calibration is necessary again.
7. Adjust the voltage source to +9.9927 volts.
8. If the gain adjustment of the analog-to-digital converter is inaccurate, either DS1 or DS2 will light.
    - If DS1 lights, rotate variable resistor R37 clockwise until both LEDs are off.
    - If DS2 lights, rotate variable resistor R37 counterclockwise until both LEDs are off.
9. Seal the end of variable resistors R35 and R37 to prevent them from moving.
10. Remove all power from the Tram module.
11. Remove the jumper from J3 and reassemble the Tram module.
12. Perform the Checkout Procedure, Current Leakage Tests, and Hi-Pot tests listed in Chapter 5: "Preventive Maintenance."

# NBP Calibration

## Accuracy

The accuracy of your non-invasive blood pressure (NBP) readings depends on the accuracy of two things:

- the zero pressure reading, and
- the voltage span of the NBP sensor in the module.

In this procedure you'll make sure that both of these items are accurate, and you'll check for NBP plumbing leaks at the same time.

## Frequency

You should perform this procedure when:

- you first get your Tram module,
- before you use it on any patients,
- once every year, and
- each you open the module to make sure the pneumatic system has no air leaks.

## Special Equipment/ Tools

You need a few items to perform this procedure.

- You need a Tram-compatible monitor, like a Tram Critical Care monitor (Tramscope or Solar display with Tram-rac housings) or a Series 70XX-type (7000, 7000RA, 7005, 7010, or 7010RA) monitor.
- You need an accurate manometer. A digital one, like the Sensym PDM200M is nice, but you can use a mercury manometer, too.
- You need an NBP tube:
  - ◆ If you have a Tram 100, 200, or 250 module, it is pn 9461-203.
  - ◆ If you have a Tram 400A module with an NBP connector that protrudes from the front of the module, you need pn 9461-208.
  - ◆ If you have a Tram 400A, 400SL, or 450SL module with a recessed NBP connector, or if you have a Tram 800A, 800SL, 850A, or 850SL module, you need pn 9461-212.
- You need an NBP cuff. Any size will do. If you don't have one, order pn 9461-301.
- You need something to wrap the cuff around. PVC pipe from your local hardware store works well.

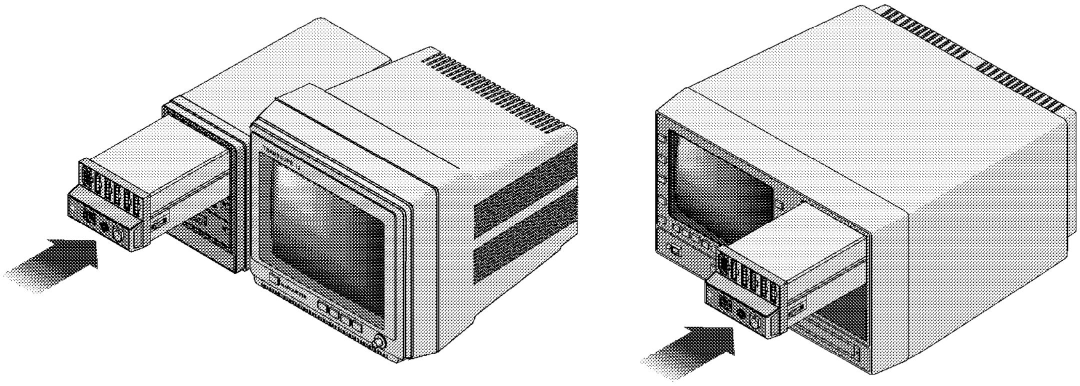
- You need these items to connect the NBP tube with the manometer and cuff.

**Table 4-1. Description**

| Item | Part Number | Qty |
|---|---|---|
| NBP Cuff Coupling | MEI PN 400787-001 | 1 |
| NBP Hose Coupling | MEI PN 46100-002 | 1 |
| NBP Tee | MEI PN 4745-101 | 1 |
| NBP Tubing | MEI PN 401582-001 | 2 |

## Preparation

Insert the module in the top slot of a Tram-rac 4 housing or Series 70XX-type.



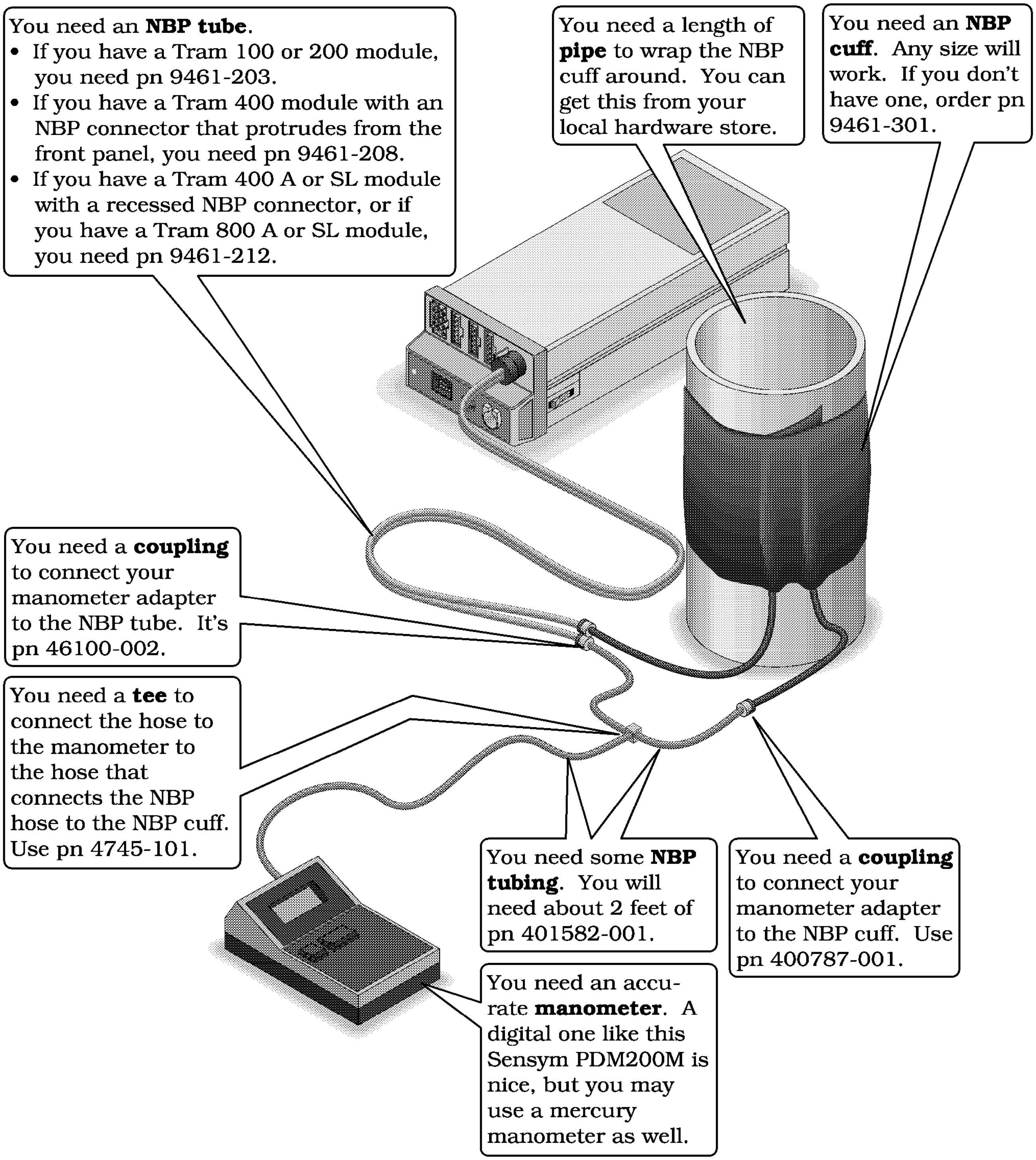
1. Disconnect all parameter cables
2. Apply power to the monitor. If your Tram-rac housing has its own power supply, apply power to it, too.
3. Enure POWER indicator on the Tram module's front panel is turned ON.

## Two Procedures

There are two different NBP calibration procedures: one for Tram modules used with Tram Critical Care monitors (Tramscope or Solar display with Tram-rac housings), and one for Tram modules used with Series 70XX-type (7000, 7000RA, 7005, 7010, or 7010RA) monitors.

**WARNING**
When the NBP cuff is used in this procedure, it must be tightly wrapped around a tube. Never put the cuff around your arm during the calibration procedures. If you do put the cuff around your arm during this procedure, you will injure yourself.

1. Connect a manometer and NBP cuff to the NBP connector on the front of the Tram module as shown below.



You need an **NBP tube**.

- If you have a Tram 100 or 200 module, you need pn 9461-203.
- If you have a Tram 400 module with an NBP connector that protrudes from the front panel, you need pn 9461-208.
- If you have a Tram 400 A or SL module with a recessed NBP connector, or if you have a Tram 800 A or SL module, you need pn 9461-212.

You need a length of **pipe** to wrap the NBP cuff around. You can get this from your local hardware store.

You need an **NBP cuff**. Any size will work. If you don't have one, order pn 9461-301.

You need a **coupling** to connect your manometer adapter to the NBP tube. It's pn 46100-002.

You need a **tee** to connect the hose to the manometer to the hose that connects the NBP hose to the NBP cuff. Use pn 4745-101.

You need some **NBP tubing**. You will need about 2 feet of pn 401582-001.

You need a **coupling** to connect your manometer adapter to the NBP cuff. Use pn 400787-001.

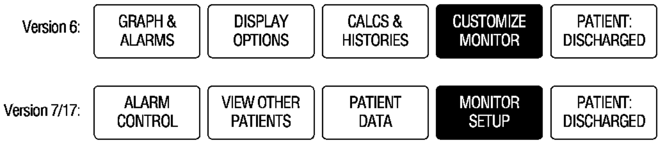
You need an accurate **manometer**. A digital one like this Sensym PDM200M is nice, but you may use a mercury manometer as well.

2. Turn the manometer ON, and set its range switch to the 1000 mmHg setting.
3. Select the appropriate procedure on the following pages.

## NBP Test for Tram Critical Care Monitors

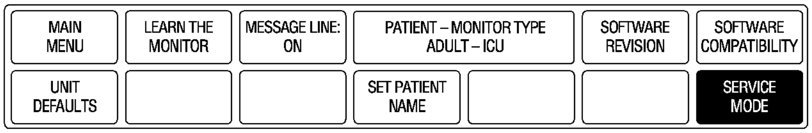
Perform this test if you are using the Tram module with a Tram Critical Care monitor (Tramscope or Solar monitor). This procedure assumes you have either version 6, 7, or 17 software in your Tramscope/Solar display, Tram-rac housing, and Tram module.

1. From the monitor's main menu, rotate the Trim Knob control to highlight CUSTOMIZE MONITOR (with version 6) or MONITOR SETUP (with version 7/17), and then press the Trim Knob control to select it.

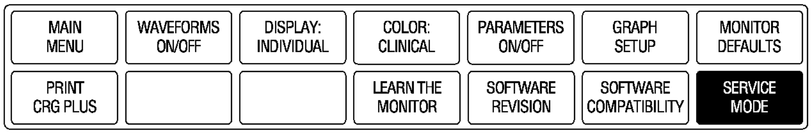

Version 6:
GRAPH & ALARMS
DISPLAY OPTIONS
CALCS & HISTORIES
CUSTOMIZE MONITOR
PATIENT: DISCHARGED
Version 7/17:
ALARM CONTROL
VIEW OTHER PATIENTS
PATIENT DATA
MONITOR SETUP
PATIENT: DISCHARGED

2. Rotate the Trim Knob control to highlight SERVICE MODE, and then press the Trim Knob control to select it.

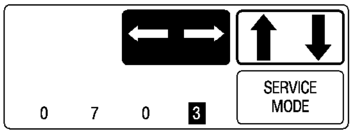
Version 6:


MAIN MENU
LEARN THE MONITOR
MESSAGE LINE: ON
PATIENT – MONITOR TYPE ADULT – ICU
SOFTWARE REVISION
SOFTWARE COMPATIBILITY
UNIT DEFAULTS
SET PATIENT NAME
SERVICE MODE

Version 7/17:


MAIN MENU
WAVEFORMS ON/OFF
DISPLAY: INDIVIDUAL
COLOR: CLINICAL
PARAMETERS ON/OFF
GRAPH SETUP
MONITOR DEFAULTS
PRINT CRG PLUS
LEARN THE MONITOR
SOFTWARE REVISION
SOFTWARE COMPATIBILITY
SERVICE MODE

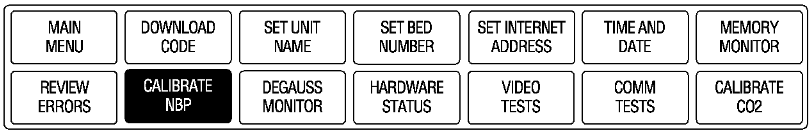
3. You have to enter a password to get into the service mode. The first two digits of the password are the day of the month, and the second two digits are the month. For example, on 7 March, the password would be 0703.
   - Rotate the Trim Knob control to highlight a password digit.
   - Press the Trim Knob control to select the password digit.
   - Rotate the Trim Knob control to change the value of the password digit.
   - Rotate the Trim Knob control to enter the password digit.
   - Repeat the steps above until all of the digits are entered.
   - Rotate the Trim Knob control to highlight SERVICE MODE from the menu.
   - Press the Trim Knob control to enter the service mode.


0 7 0 3
SERVICE MODE

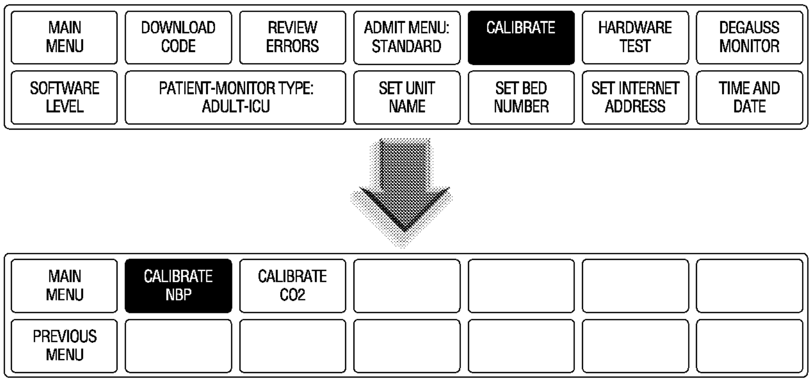
4. If you have version 6 software, rotate the Trim Knob control to highlight CALIBRATE NBP, and then press the Trim Knob control to select it.

   If you have version 7/17 software, rotate the Trim Knob control to highlight CALIBRATE, and press the Trim Knob control to select it. Then rotate the Trim Knob control to highlight CALIBRATE NBP, and press the Trim Knob control to select it.

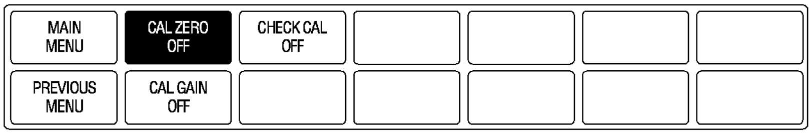
Version 6:


MAIN MENU
DOWNLOAD CODE
SET UNIT NAME
SET BED NUMBER
SET INTERNET ADDRESS
TIME AND DATE
MEMORY MONITOR
REVIEW ERRORS
CALIBRATE NBP
DEGAUSS MONITOR
HARDWARE STATUS
VIDEO TESTS
COMM TESTS
CALIBRATE CO2

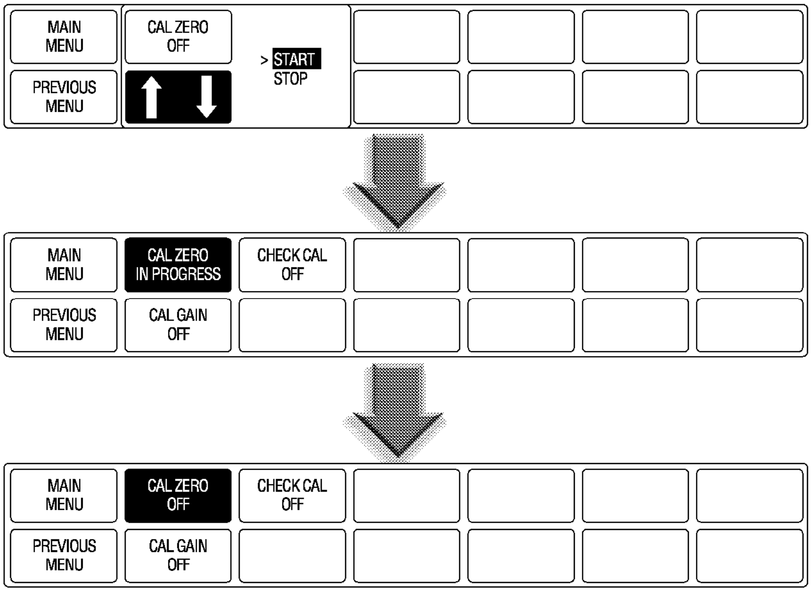
Version 7/17:


MAIN MENU
DOWNLOAD CODE
REVIEW ERRORS
ADMIT MENU: STANDARD
CALIBRATE
HARDWARE TEST
DEGAUSS MONITOR
SOFTWARE LEVEL
PATIENT-MONITOR TYPE: ADULT-ICU
SET UNIT NAME
SET BED NUMBER
SET INTERNET ADDRESS
TIME AND DATE
MAIN MENU
CALIBRATE NBP
CALIBRATE CO2
PREVIOUS MENU

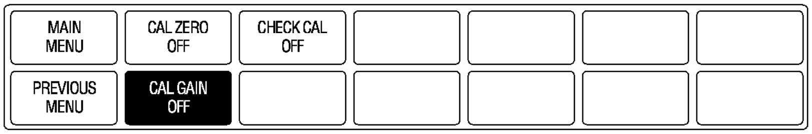
5. Rotate the Trim Knob control to highlight CAL ZERO OFF, and then press the Trim Knob control to select it.


MAIN MENU
CAL ZERO OFF
CHECK CAL OFF
PREVIOUS MENU
CAL GAIN OFF

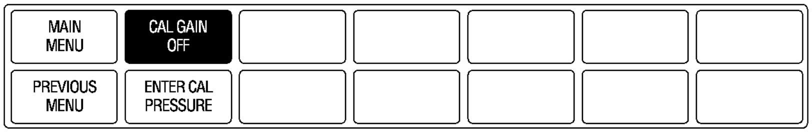
6. Rotate the Trim Knob control to highlight START, and then press the Trim Knob control to select it. The CAL ZERO menu item will show that it is IN PROGRESS, and when it is done it will display OFF again.


MAIN MENU
CAL ZERO OFF
> START
STOP
PREVIOUS MENU
MAIN MENU
CAL ZERO IN PROGRESS
CHECK CAL OFF
PREVIOUS MENU
CAL GAIN OFF
MAIN MENU
CAL ZERO OFF
CHECK CAL OFF
PREVIOUS MENU
CAL GAIN OFF

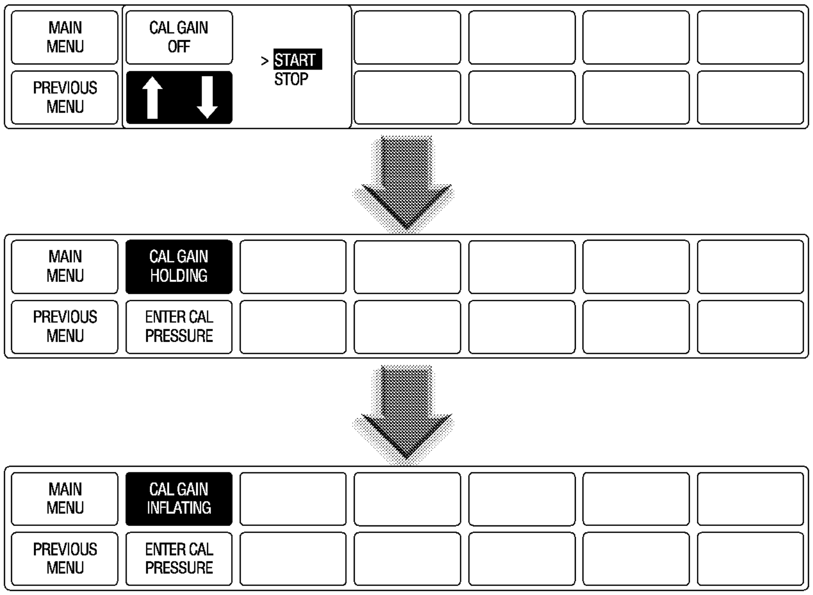
7. Rotate the Trim Knob control to highlight CAL GAIN OFF, and then press the Trim Knob control to select it.


MAIN MENU
CAL ZERO OFF
CHECK CAL OFF
PREVIOUS MENU
CAL GAIN OFF

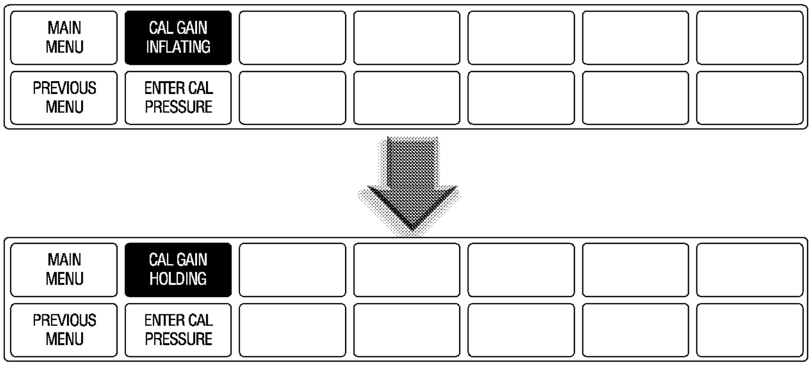
8. Rotate the Trim Knob control to highlight CAL GAIN OFF, and then press the Trim Knob control to select it.


MAIN MENU
CAL GAIN OFF
PREVIOUS MENU
ENTER CAL PRESSURE

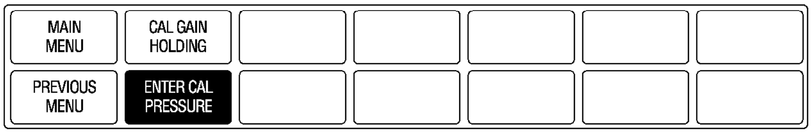
9. Rotate the Trim Knob control to highlight START, and then press the Trim Knob control to select it. The second line of text on the CAL GAIN menu item changes from HOLDING to INFLATING. Then, the Tram module starts pumping up the pressure bulb or cuff—you'll hear the whirring sound of the NBP pump motors, and you'll see an increase in displayed pressures on both the Tramscope or Solar display and the manometer.


MAIN MENU
CAL GAIN OFF
> START
STOP
PREVIOUS MENU
MAIN MENU
CAL GAIN HOLDING
PREVIOUS MENU
ENTER CAL PRESSURE
MAIN MENU
CAL GAIN INFLATING
PREVIOUS MENU
ENTER CAL PRESSURE

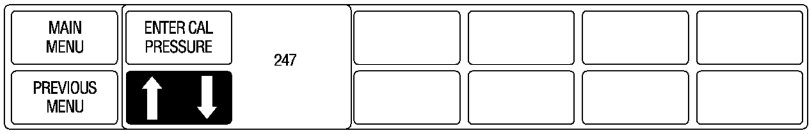
10. The pump shuts off at about 250 mmHg, and the pressure drops slowly to about 240 mmHg before stabilizing. The second line of text on the CAL GAIN menu item changes from INFLATING back to HOLDING. If the pressure continues to drop at a rate of 1 mmHg or more for every five seconds, there is a leak in the NBP plumbing. If there is a leak in the NBP plumbing, you'll have to repair it and restart this calibration procedure.


MAIN MENU
CAL GAIN INFLATING
PREVIOUS MENU
ENTER CAL PRESSURE
MAIN MENU
CAL GAIN HOLDING
PREVIOUS MENU
ENTER CAL PRESSURE

11. Rotate the Trim Knob control to highlight ENTER CAL PRESSURE, and then press the Trim Knob control to select it.

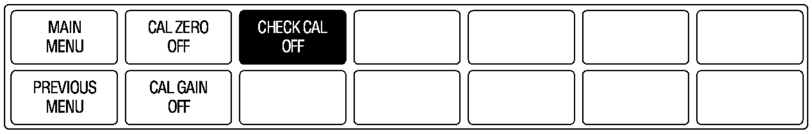

MAIN MENU
CAL GAIN HOLDING
PREVIOUS MENU
ENTER CAL PRESSURE

12. An ENTER CAL PRESSURE popup window will appear. Use the Trim Knob control to select a pressure value that is 1 mmHg lower than the current manometer reading.

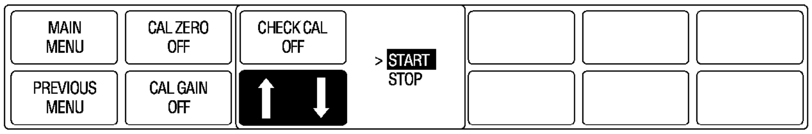

MAIN MENU
PREVIOUS MENU
ENTER CAL PRESSURE
247

13. When the manometer falls to exactly the value that you selected in the popup window, press the Trim Knob control to enter the value.

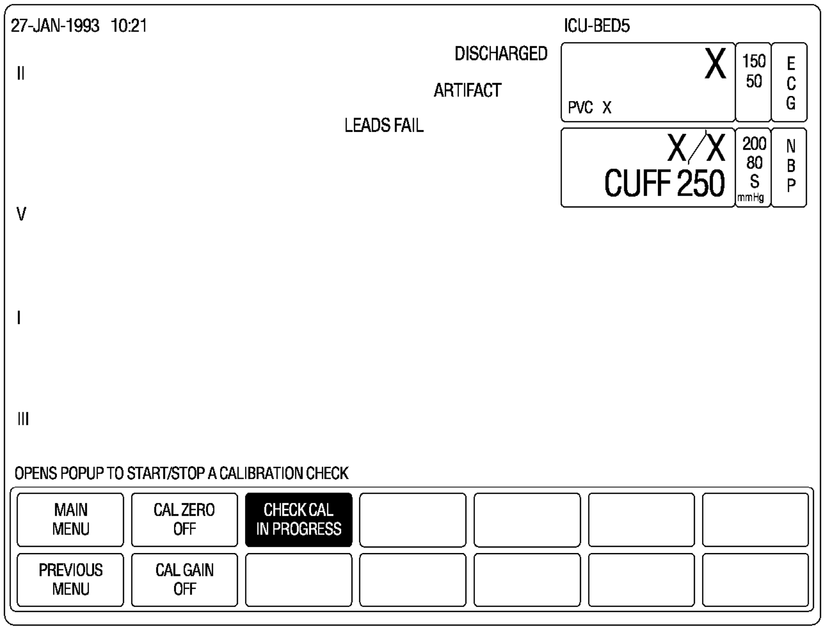
14. Rotate the Trim Knob control to highlight CHECK CAL OFF, and then press the Trim Knob control to select it.


MAIN MENU
PREVIOUS MENU
CAL ZERO OFF
CAL GAIN OFF
CHECK CAL OFF

15. Rotate the Trim Knob control to highlight START, and then press the Trim Knob control to select it.

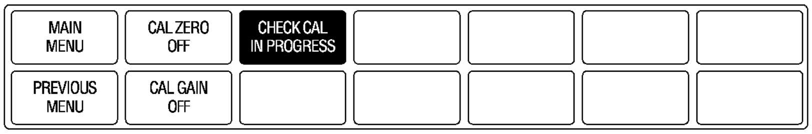

MAIN MENU
PREVIOUS MENU
CAL ZERO OFF
CAL GAIN OFF
CHECK CAL OFF
> START
STOP

16. The text on the menu item will change from CHECK CAL OFF to CHECK CAL IN PROGRESS. Make sure that the pressure readings (shown as CUFF in the NBP parameter box) on the Tramscope or Solar display and manometer are equal (± 1 mmHg) for at least one full minute.

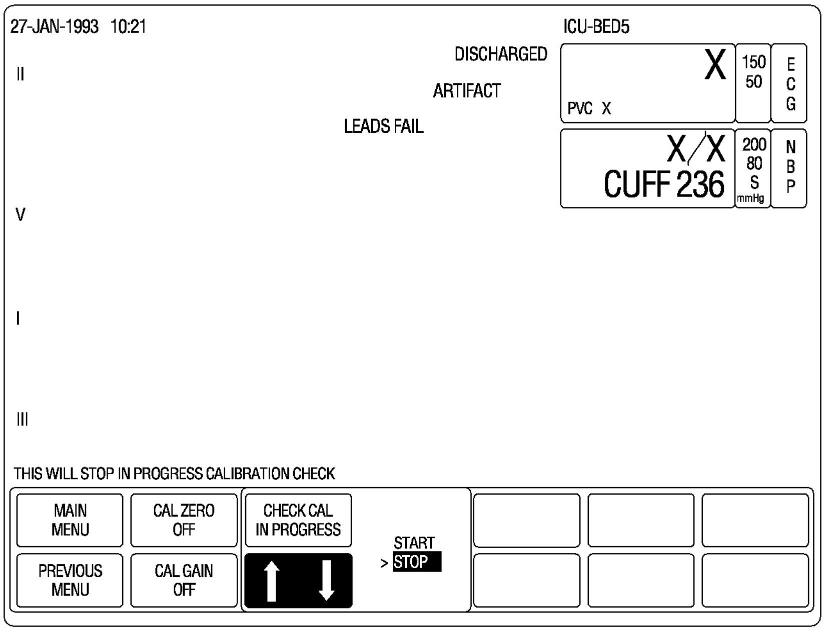

27-JAN-1993 10:21
ICU-BED5
DISCHARGED
ARTIFACT
LEADS FAIL
II
V
I
III
X
PVC X
150
50
E C G
X/X
CUFF 250
200
80
S
mmHg
N B P
MAIN MENU
PREVIOUS MENU
CAL ZERO OFF
CAL GAIN OFF
CHECK CAL IN PROGRESS

OPENS POPUP TO START/STOP A CALIBRATION CHECK

17. Rotate the Trim Knob control to highlight CHECK CAL IN PROGRESS, and then press the Trim Knob control to select it.


MAIN MENU
CAL ZERO OFF
CHECK CAL IN PROGRESS
PREVIOUS MENU
CAL GAIN OFF

18. Rotate the Trim Knob control to highlight STOP, and then press the Trim Knob control to select it. The module then releases pressure in the bulb or cuff.


27-JAN-1993 10:21
ICU-BED5
DISCHARGED
ARTIFACT
LEADS FAIL
II
V
I
III
X
PVC X
150
50
E C G
X/X
CUFF 236
200
80
S
mmHg
N B P
MAIN MENU
CAL ZERO OFF
CHECK CAL IN PROGRESS
PREVIOUS MENU
CAL GAIN OFF
START
> STOP

THIS WILL STOP IN PROGRESS CALIBRATION CHECK

This completes the NBP calibration procedure. Remove the cuff and manometer from the Tram module.

## NBP Test for Series 70XX Monitors

You should run this test if you use your Tram module with a Series 70XX-type monitor (Series 7000, 7000RA, 7005, 7010, or 7010RA monitors).

1. Press the SYSTEM key on the monitor.
2. Press the MONITOR SETUP, MONITOR SERVICE, and then CALIBRATE NBP soft keys. Soft keys are the unlabeled keys under the display. The function of each key appears on the display, just above the key.
3. If an NBP cuff is attached to the Tram module, remove it.
4. Press the YES soft key.
5. Press the SET ZERO soft key. The module will then take about 10 seconds to internally set its zero reference point. After this reference point is set, the SET ZERO will no longer be highlighted — it will be return to the same intensity as the rest of the characters on the display.
6. Turn the manometer on, and set its range switch to the 1000 mmHg setting.
7. Press the SET PRESSURE soft key. Make sure the Tram module starts to pump up the pressure bulb or cuff. You can tell it's pumping by the whirring sound of the NBP pump motors, and the increase in displayed pressures on the monitor and manometer.
8. The pump should shut off at approximately 250 mmHg, and the pressure will begin to drop slowly to about 240 mmHg before stabilizing. If the pressure continues to drop at a rate of 1 mmHg or more for every four seconds, there is a leak in the system. If there is a leak in the system, repair it and restart the calibration procedure.
9. At the monitor, key in a pressure value that is 1 mmHg lower than the current manometer reading.
10. When the manometer falls to exactly the value that you keyed into the monitor, press the ENTER key on the monitor.
11. Press the TEST CAL soft key and verify that the pressure readings on the monitor and manometer are equal (± 1 mmHg) for at least one minute.
12. Press the TEST CAL soft key to stop the test.
13. Press the CLEAR key.

This completes the NBP calibration procedure. Remove the cuff and manometer from the Tram module.

# Software Update Procedure

This procedure is provided for any Tram modules that may require updating. It describes how to download new software into Tram 100-850 A or SL module by using a laptop personal computer or terminal with programmed software diskettes.

## Required Special Tools/ Equipment

This update procedure requires the user to have the following to download the Tram software.

- Tram module update diskette (Call your sales representative for the latest update kit part numbers and for software compatibility issues.)
- a personal computer (PC) to download the software, and
- a download cable kit, pn 404307-001.

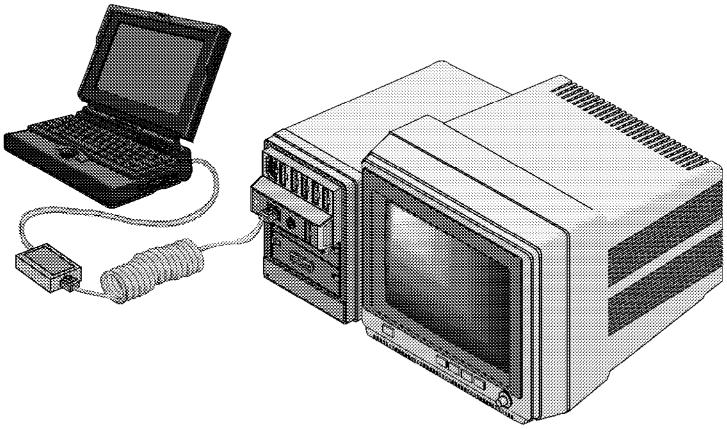
The laptop computer (PC) must have the following minimum requirements:

- it must be MS-DOS compatible,
- have a 720K, 3.5-inch diskette drive, and
- have an RS-232 serial port.

## Interconnection

To connect the PC to the Tram module, do the following steps in the order given.

- Connect the Tram module cable (part of the download kit) to the display connector on the front of the Tram module.
- Connect the other end of the Tram module cable to the RS-232C to RS-422 converter. Note the RS-232C to RS-422 converter is powered by the module and does not require connection to a power source.
- Connect the PC cable assembly from the RS-232C to RS-422 converter to the D-type connector labeled COMMS or COMM 1 at the rear of the PC.



## PC Setup

1. Insert the Tram module into an updated Tram-rac chassis (or Series 70XX monitor.) Ensure the power light on the front of the Tram module illuminates.
2. Insert the Tram module update diskette into drive A of the PC.
3. If the PC prompt is not A:\>, type A:\ and press the ENTER key. The PC will respond with an A:\> prompt.
4. Type UPDATE and press the ENTER key. The update program is loaded and will list the Tram Critical Care Monitor UPDATE UTILITIES menu.
5. Press the F7 key until the serial port name that the download converter module is connected to appears in the lower right box of the main menu.

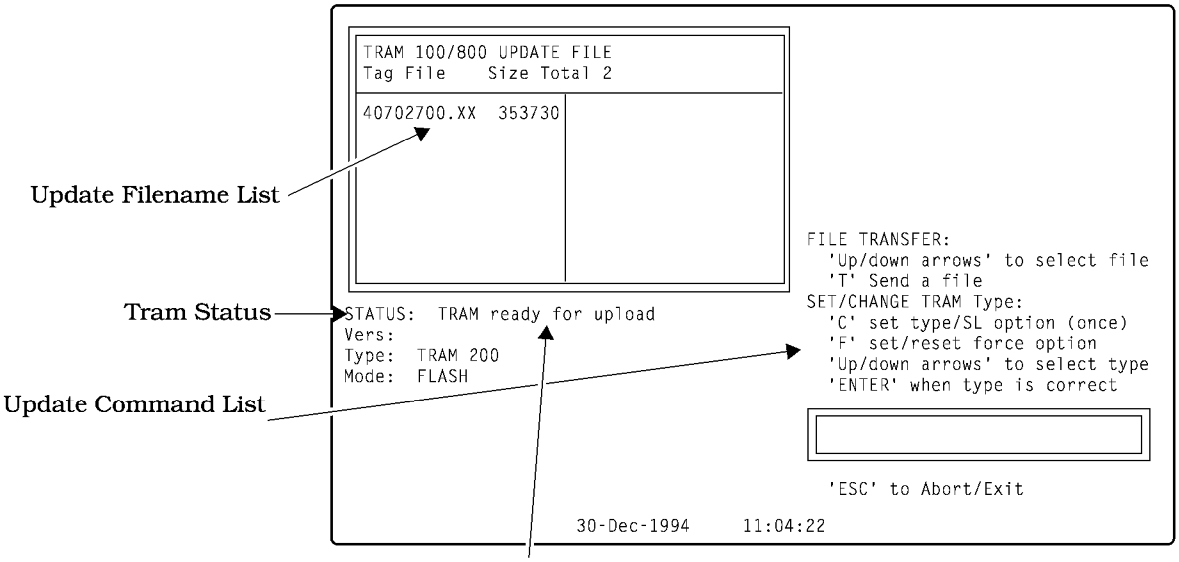
## Generic Procedure

Do the following to update each Tram module.

1. Press the F5 key to select TRAM UPDATE menu.

**NOTE:** If the PC locks up, turn it OFF, remove the diskette from the drive, and start again. (REBOOT)

2. You should see a screen similar to the following.



```
TRAM 100/800 UPDATE FILE
Tag File    Size Total 2

40702700.XX  353730

                                      FILE TRANSFER:
                                        'Up/down arrows' to select file
                                        'T' Send a file
                                      SET/CHANGE TRAM Type:
STATUS:  TRAM ready for upload          'C' set type/SL option (once)
Vers:                                   'F' set/reset force option
Type:  TRAM 200                         'Up/down arrows' to select type
Mode:  FLASH                            'ENTER' when type is correct

                                        'ESC' to Abort/Exit

                  30-Dec-1994     11:04:22
```

**NOTE:** The version field in the above display should contain data describing the current version of software in the Tram module.

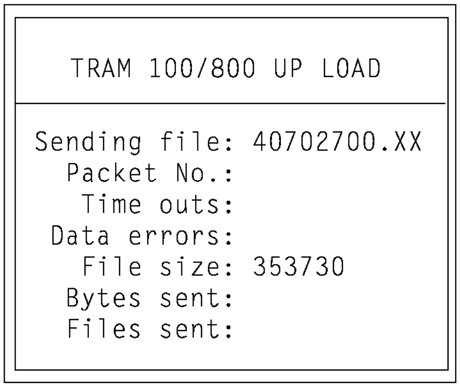
3. Watch the Tram module status. You should see the following messages.

   Trying to Talk to Tram
   Getting Software Revision
   Getting Tram Type
   Tram Ready for Upload

   Just below Tram status, you will see the current software version, Tram type, and mode.

4. Use the ↓ key to highlight the file that you want to upload and type T or <ENTER> to tag and send the file. The Tram module status will display an UPLOADING TO TRAM message.

5. In the upper right corner of the computer's screen, a box containing file name, number of bytes, and other download parameters will appear. These fields will be updated while the software is uploaded. Below that box there is a message area that shows LOADING FILE and then USING CCITT-CRC as the upload begins.



```
   TRAM 100/800 UP LOAD

Sending file: 40702700.XX
  Packet No.:
   Time outs:
 Data errors:
   File size: 353730
  Bytes sent:
  Files sent:
```

* XX indicates the software version.

6. As the PC downloads software to the Tram module, the PACKET NO. and BYTES SENT fields are incremented. The data errors field may also be incremented during the upload. Data errors cause packets to be automatically sent again to the Tram module, so an occasional data error should be disregarded. However, if the data errors are continuous, the Tram module should be serviced.

   If the TIME OUTS field is continuously incremented, it detects a communication error. Disconnect the Tram module, press the ESC key, and start this procedure again.

7. When the software download is complete, the following messages are displayed for the Tram module status.

   Waiting for Tram to restart
   Telling Tram to run in flash
   Getting Software Revision
   Setting Tram Type
   Getting Tram Type
   Tram Upload Complete

   The PC will sound a tone to show that the software upload is complete.

8. Ensure Tram module type, shown below Tram module status. If the Tram module type displayed does not match the type of Tram module that you are updating, it will have to be changed as follows.

   - Type C (or c) to display the Tram type selections (i.e. 100/200/250/300/400/450/500/600/750/800/850.) The selections are also repeated with the SL option. The Tram must be SL capable (hardware/memory changes) to be set with the SL option.
   - Use the ↓ and ↑ keys to scroll through the various Tram types (e.i. 100, 200SL, etc.).
   - The updated Tram type is displayed for the Tram status. A Tram that is not SL capable will respond with the Tram type (e.i. 100), but will NOT have the SL option. The message SL OPTION IS NOT ALLOWED will appear below the mode type.
   - The following sequence should appear for the Tram module status.

     Setting Tram Type
     Getting Software Revision
     Getting Tram Type
     Tram Ready For Upload (or Tram upload complete)

   The software download is now complete.

   If you are updating several Tram modules, you may force all Tram modules to one type by selecting an 'F.' When this option is set, the Tram module's type is forced to one specified type (i.e. 200SL). This option remains set until it is reset by hitting 'F' again.

9. Disconnect the Tram module from the download module.
10. Press the ESC key on the PC to return to the main menu.

## Completion

This completes the Tram module software update.

1. Continue with the software update for other modules.
2. Before returning a module to service, perform the Checkout Procedure provided in Chapter 5: "Preventive Maintenance."

*For your notes*

# 5 PREVENTIVE MAINTENANCE

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# Equipment Maintenance Program

## Recommended Maintenance Schedule

A regular equipment maintenance program helps prevent unnecessary equipment and power failures and also reduces possible health hazards. The maintenance schedule for the Tram 100-850 A and SL modules include the following:

- Inspection; Do this before each time the module is used with a patient.
- General cleaning; Do this before each time the module is used with a patient.
- Checkout procedures; Do these when you first get your module (before you use it to monitor patients), every six months thereafter, and each time you remove and replace a circuit board.
- Current leakage tests; Do these when you first get your module (before you use it to monitor patients), every six months thereafter, and each time you remove and replace a circuit board. Leakage tests verify that the equipment does not propose a health hazard.
- Hi-pot tests; Do these each time you open the acquisition module.
- NBP calibration (refer to Chapter 4: “Calibration”); Do this when you first get your module (before you use it to monitor patients), every year thereafter, and each time you remove and replace a circuit board.

## Recommended Frequency

To help you establish a systematic maintenance routine, Marquette Electronics recommends that you perform all maintenance procedures presented in this chapter.

- upon receipt of the module,
- every six months thereafter,
- each time a circuit board is removed or replaced, and
- record the results on the “Preventive Maintenance Inspection Form,” included at the end of this chapter.

**WARNING**
Failure to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards. Unless you have an Equipment Maintenance Contract, Marquette Electronics does not in any manner assume the responsibility for performing the recommended maintenance procedures. The sole responsibility rests with the individual or institution using the equipment. Marquette Electronics service personnel may, at their discretion, follow the procedures provided in this manual as a guide during visits to the equipment site.

# Inspection and Cleaning

## Visual Inspection

Remove module before making an inspection or cleaning the module.

- Check the case for cracks or other damage.
- Regularly inspect cables for fraying or other damage.
- Inspect all plugs, cables, and connectors for bent prongs or pins.
- Make sure the latches work properly:
    - When you install the Tram module in a monitor, it should be latched firmly into place and should not slide out of the monitor without pressing the latch buttons.
    - When you press the latch buttons, the Tram module should slide easily out of the monitor
- Verify that all cables and connectors are securely seated. Note that replacement of components should be performed only by qualified service personnel.

## Cleaning Precautions

To avoid damage to the equipment surfaces, do not use the following cleaning agents:

- organic solvents,
- ammonia based solutions,
- acetone solution,
- alcohol based cleaning agents,
- Bentadine solution,
- a wax containing a cleaning substance, or
- abrasive cleaning agents.

**Table 5-1. Recommended Cleaning Supplies**

| Item | Part Number |
|---|---|
| Ammonia (diluted) or<br>Cidex solution, or<br>Sodium hypochlorite bleach (diluted), or<br>Mild soap (diluted) | – |
| Lint-free cloth | TX609 |
| Dust remover (compressed air) | – |

## Exterior Cleaning

Clean the exterior surfaces with a clean, lint-free cloth and one of the cleaning solutions listed above.

- Wring the excess water from the cloth. Do not drip any liquid into open vents, plugs, or connectors.
- Dry the surfaces with a clean cloth or paper towel.

# Checkout Procedure

The following pages describe the checkout procedures for the Tram module. We provide you with these procedures so you can verify the operational performance of the Tram module. If you do not get the results listed in the procedures, your Tram module might not be working properly.

The checkout procedures consist of several tests. You should perform all of the tests applicable to your Tram module in the order in which they are listed.

## Test Frequency

This procedure tests the functions of each parameter of the module. We recommend this checkout procedure be performed:

- upon receipt of the module,
- every six months thereafter, and
- each time the module is open or repaired.

Remember to record the date and results on the "Maintenance/ Repair Log" included at the end of this chapter.

## Required Tools/Special Equipment

These procedures are based on the assumption that the module under test is used with known good cables and known good test equipment. It also assumes that you are at least somewhat familiar with the operation of all devices required for the procedures. For more information concerning the operation of these components, consult the appropriate operator's manuals.

The following paragraphs list the test equipment, adapters, and cables necessary to complete the checkout procedures. You can use equivalent equipment, but the procedures were written for the test equipment listed here, so you might have to slightly modify some test steps, because the values listed in the steps take into account the accuracy of the simulators, as well as the accuracy of the module. The "Technical Specifications" in Chapter 2: "General Information" for details about the module's accuracy specifications.

1. You will need a monitor to plug the Tram module into. You may use any of these monitors:
   - a Tram Critical Care monitor (a Tramscope display with a Tram-rac housing).
   - a Series 7000 or 7000RA monitor that has been modified to be Tram-compatible, or
   - a Series 7005, 7010, or 7010RA monitor.

2. You will need the simulators and cables listed below to provide waveforms and patient vital signs.

**CAUTION**
You should never use a patient simulator as a calibration reference because they are generally not precise enough to be trusted as a reference. Make sure that your simulator is accurate by testing it on a known-good monitor.

**Table 5-2. Suggested Simulators and Cables**

| Item | Part Number |
|---|---|
| Multifunction Micro-Simulator | MEI PN MARQ-1 |
| Cardiac Output Simulator II | MEI PN 900028-001 |
| $SpO_2$ Simulator | MEI PN 408610-001 |
| ECG Patient Cable | MEI compatible |
| ECG Leadwire Set | MEI compatible |
| Blood Pressure Simulator Cable | MEI PN 700095-001 |
| Temperature Adapter | MEI PN 402015-004 |
| Temperature Simulator Cable | MEI PN 6770031 |
| Cardiac Output Cable Adapter | MEI PN 700092-001 |
| MEI (Nellcor-style) $SpO_2$ Simulator Cable OR (Ohmeda-Style $SpO_2$ Simulator Cable) | MEI PN 700232-004<br>OR<br>MEI PN 700232-002) |

3. You can use any patient cable or leadwire set that you would usually use on patients.
4. You need these items to build an NBP test fixture:

**Table 5-3. Description**

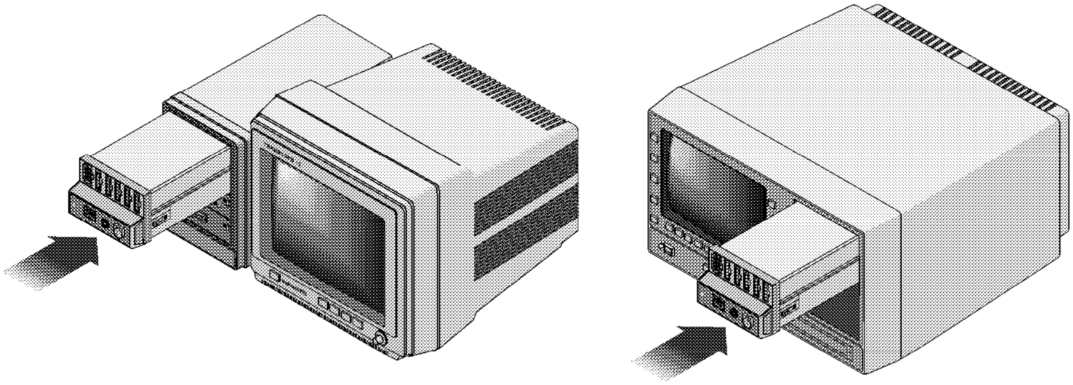
| Item | Part Number | Qty |
|---|---|---|
| NBP Cuff Coupling | MEI PN 400787-001 | 1 |
| NBP Hose Coupling | MEI PN 46100-002 | 1 |
| NBP Tee | MEI PN 4745-101 | 1 |
| NBP Tubing | MEI PN 401582-001 | 2 |

5. You need an accurate manometer for the NBP test. A digital one, like the Sensym PDM200M is nice, but you can use a mercury manometer, too.

6. You need an NBP tube for the NBP test:
    - If you have a Tram 100 or 200 module, you will need pn 9461-203.
    - If you have a Tram 400A module with an NBP connector that protrudes from the front of the module, you will need pn 9461-208.
    - If you have a Tram 400 A or SL module with a recessed NBP connector, or if you have a Tram 800 A or SL module, you will need pn 9461-212.
7. You need an NBP cuff for the NBP test. Any size will work. If you do not have one, order pn 9461-301.
8. You need something to wrap the cuff around during that test. PVC pipe from your local hardware store works good.
9. You need an oscilloscope for the DEFIB SYNC test. Since you will use it to view low-frequency ECG and BP waveforms, almost any kind of oscilloscope will work.
10. You need a Smart-pac transport display, or a Series 7200 Tram transport display fitted with a Smart-pac battery backpack.
11. You need a cable to connect your Tram module to the transport display. If you do not already have one, pn 403495-001 is a 3-meter (10-foot) cable.

## General Test

1. Install the module in a Tram-rac 4 housing or Series 70XX-type monitor.



2. Apply power to monitor by turning the rear panel power switch to the ON position.
3. Turn the display ON by pressing the DISPLAY ON/OFF or POWER key on the front panel of the monitor.
4. Make sure the power indicators ON both the monitor and the Tram module are turned ON.
5. Connect patient cable to module.
6. Attach appropriate leads to the simulator.

## Parameter Tests

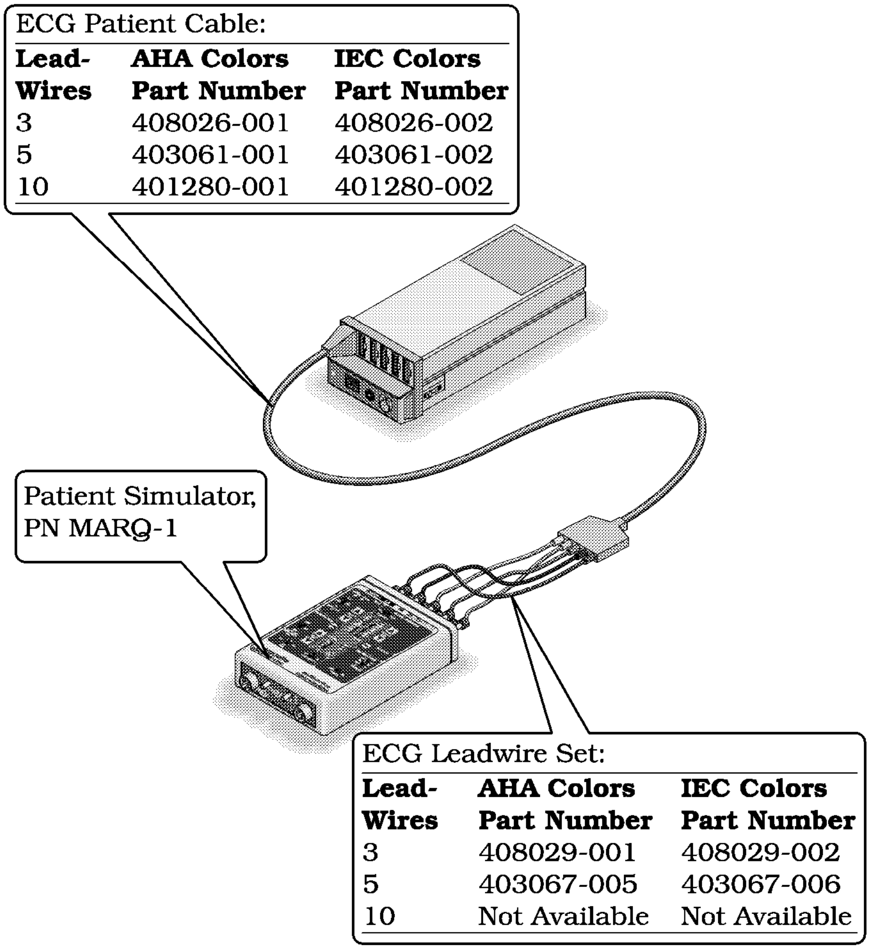
Select the appropriate tests to verify all parameters of the module under test. The parameter tests are presented in the following order.

- ECG Test
- 12SL ECG Test
- Respiration Test
- BP Test
- Temperature Test
- CO Test
- $SpO_2$ Test
- NBP Test

**CAUTION**
Make sure to test all parameters per module.

## ECG Test

1. Set up the simulator like this:
   - Set heart rate to 80 bpm.
   - Set ECG amplitude to 1.0 mV.
2. Attach a patient cable and leadwires between the ECG connector on the Tram module and the leadwire connectors on the top of the patient simulator.



ECG Patient Cable:

| Lead-Wires | AHA Colors Part Number | IEC Colors Part Number |
|---|---|---|
| 3 | 408026-001 | 408026-002 |
| 5 | 403061-001 | 403061-002 |
| 10 | 401280-001 | 401280-002 |

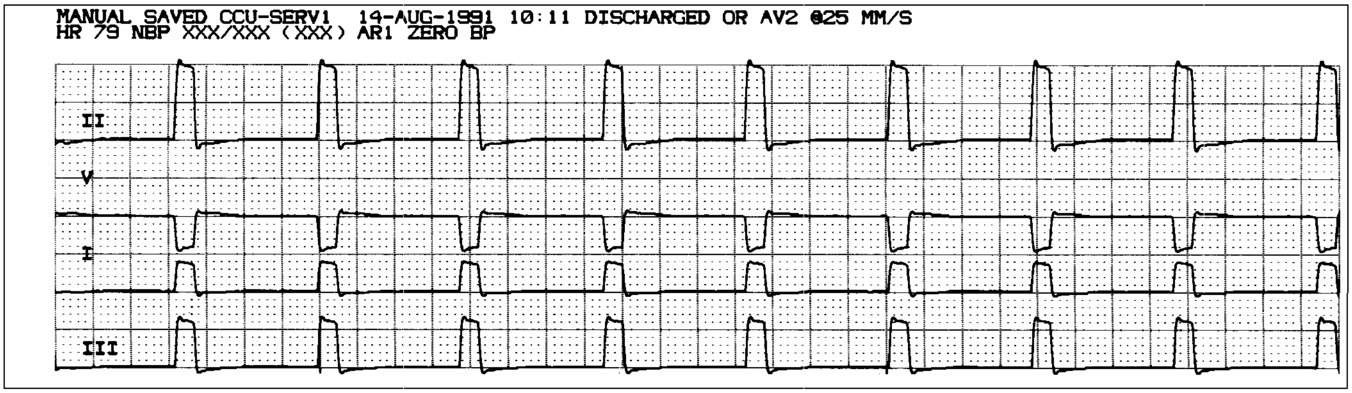
Patient Simulator, PN MARQ-1

ECG Leadwire Set:

| Lead-Wires | AHA Colors Part Number | IEC Colors Part Number |
|---|---|---|
| 3 | 408029-001 | 408029-002 |
| 5 | 403067-005 | 403067-006 |
| 10 | Not Available | Not Available |

3. Admit a patient into system.
4. Make sure the following conditions are true:
   - The monitor displays ECG lead II, and it is noise-free.
   - The monitor displays an 80 ±1 bpm heart rate.
   - If the monitor has QRS tones are turned ON, an audible tone sounds with each QRS complex.
5. Make sure all seven ECG leads are available for display and they are noise-free.
6. Set DETECT PACE to NORMAL.
7. Inject a VP2 pacemaker pulse with the simulator.

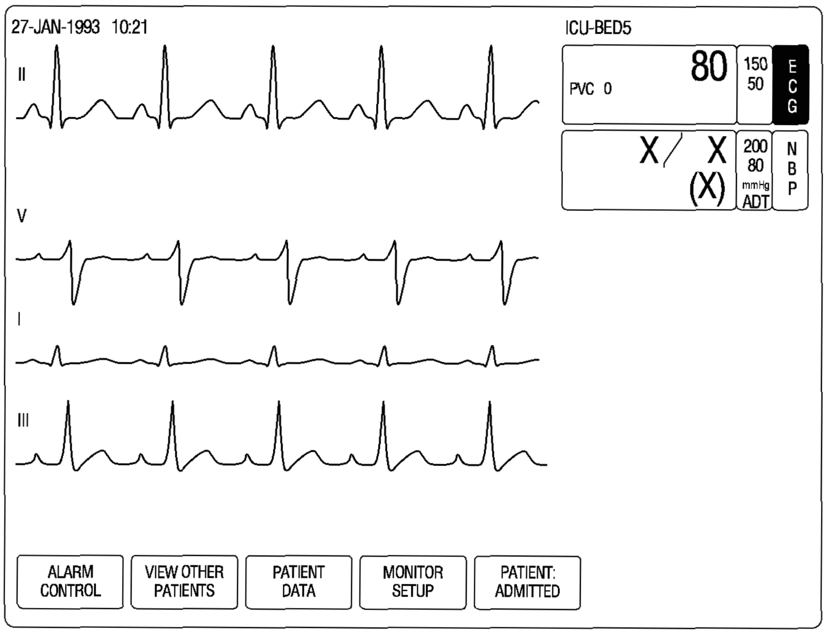
8. Observe following with leads II, III, aVR, aVF, and V:
    - On the monitor, a P appears above the PVC count to denote pacemaker mode.
    - The monitor still shows an 80 ±1 bpm heart rate.
9. Remove the pacemaker pulse input and return the simulator to these conditions:
    - Set heart rate to 80 bpm.
    - Set amplitude to 1.0 mV.
10. Select lead II for display in the top trace position.
11. Remove the RA leadwire from the patient cable.
12. Observe following:
    - The monitor displays an RA FAIL message.
    - The monitor displays lead III in place of lead II.
13. Replace the RA leadwire.
14. Inject a 1-millivolt calibration pulse with the simulator and start a manual graph.
15. Observe that the calibration pulses are properly displayed and graphed, like in the example below.



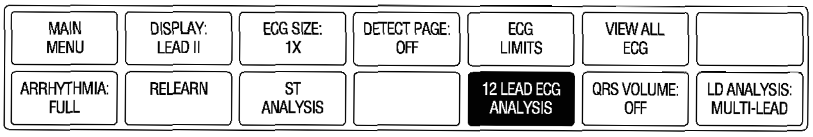
## 12SL ECG Test

This test is only necessary for SL-type Tram modules. It requires that the Tram module use version 7 (or later) software, and that the monitor uses a Tramscope 12 or 12C display with version 7 or 17 (or later), Series 7030 software.

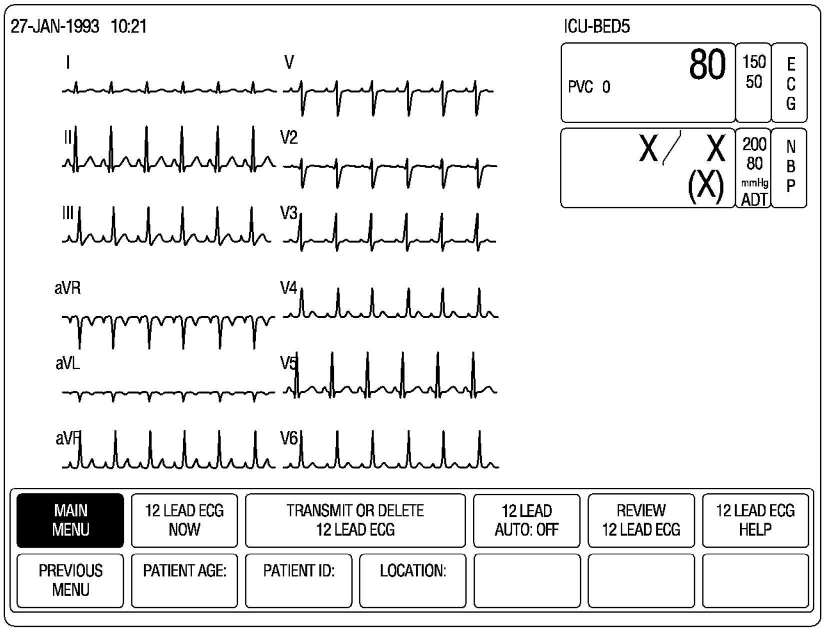
1. At the monitor, return to the Main Menu.
2. Turn the Trim Knob control to highlight the ECG parameter box, and press the Trim Knob control to select it.


27-JAN-1993 10:21
ICU-BED5
II
V
I
III
PVC 0
80
150
50
ECG
X/ X
(X)
200
80
mmHg
ADT
NBP
ALARM CONTROL
VIEW OTHER PATIENTS
PATIENT DATA
MONITOR SETUP
PATIENT: ADMITTED

3. At the ECG menu, rotate the Trim Knob control to highlight 12 LEAD ECG ANALYSIS, and then press the Trim Knob control to select it.


MAIN MENU
DISPLAY: LEAD II
ECG SIZE: 1X
DETECT PAGE: OFF
ECG LIMITS
VIEW ALL ECG
ARRHYTHMIA: FULL
RELEARN
ST ANALYSIS
12 LEAD ECG ANALYSIS
QRS VOLUME: OFF
LD ANALYSIS: MULTI-LEAD

4. Make sure that all 12 ECG traces are noise-free, and they are displayed clearly.

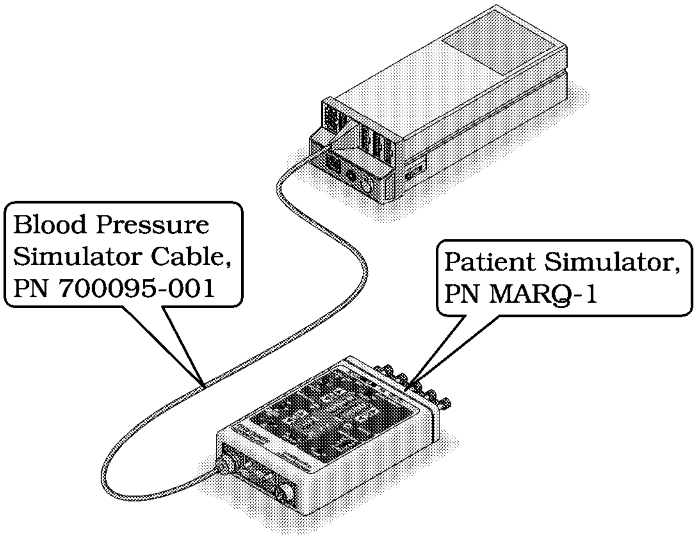

27-JAN-1993 10:21
ICU-BED5
I
II
III
aVR
aVL
aVF
V
V2
V3
V4
V5
V6
80
PVC 0
150
50
E C G
X/ X
(X)
200
80
mmHg
ADT
N B P
MAIN MENU
12 LEAD ECG NOW
TRANSMIT OR DELETE 12 LEAD ECG
12 LEAD AUTO: OFF
REVIEW 12 LEAD ECG
12 LEAD ECG HELP
PREVIOUS MENU
PATIENT AGE:
PATIENT ID:
LOCATION:

## Respiration Test

1. Set up simulator like this:
   - Set baseline impedance to 750Ω.
   - Set ΔR to 0.5Ω.
   - Set lead select to I & II.
   - Set respiration rate to 30 breaths per minute.
2. Set up the monitor like this:
   - Turn the respiration waveform ON.
   - Set the respiration waveform to lead II.
3. Observe these conditions:
   - The monitor displays a distortion-free respiration waveform.
   - The monitor displays a respiration rate reading of 30 ±2 breaths per minute.
4. Set the respiration waveform to lead I at the monitor and observe the same conditions as in step 3.

## Blood Pressure Test

1. Set up simulator like this:
   - Set polarity to POS.
   - Set output to 0 mmHg.
2. Connect a cable from the BLOOD PRESSURE 1 connector of the simulator to the left most BP connector (BP1) of the Tram module.

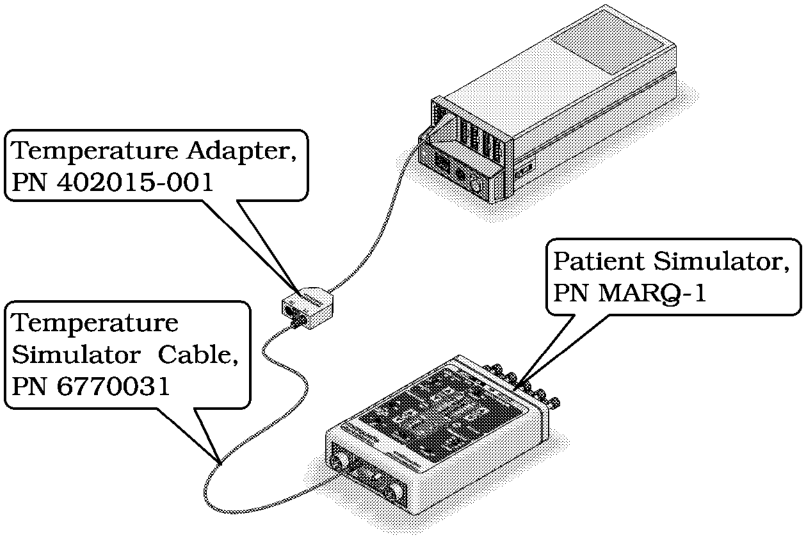

Blood Pressure Simulator Cable, PN 700095-001
Patient Simulator, PN MARQ-1

3. Observe an AR1 label and graticules on the monitor.
4. Zero the AR1 waveform.
5. Set the simulator to output 200 mmHg.
6. Observe a reading of 200/200 (200) ± 4 mmHg on the monitor.
7. Set the simulator to WAVE output.
8. Set the waveform gain on the monitor to auto.
9. Observe a distortion free waveform and a blood pressure reading of approximately 120/80 (93) on the monitor.
10. Remove the cable from the BP1 connector of the Tram module and insert it into the BP2 connector.
11. Observe a PA2 label and graticules on the monitor.
12. Set the simulator to output 0 mmHg.
13. Zero the PA2 waveform.
14. Repeat steps 5 through 9 of this test.
15. If you are testing a Tram 100A, 200A, or 200SL module, proceed to the TEMP Test.
16. Remove the cable from the BP1 connector of the Tram module and insert it into the BP3 connector.
17. Observe a CVP label and graticules on the monitor.
18. Set the simulator to output 0 mmHg.
19. Zero the CVP waveform.
20. Repeat steps 5 through 9 of this test.

21. If you are testing a Tram 400A or 400SL module, proceed to the TEMP Test.
22. Remove the cable from the BP1 connector of the Tram module and insert it into the BP4 connector.
23. Observe an LA label and graticules on the monitor.
24. Set the simulator to output 0 mmHg.
25. Zero the LA waveform.
26. Repeat steps 5 through 9 of this test.

## Temperature Test

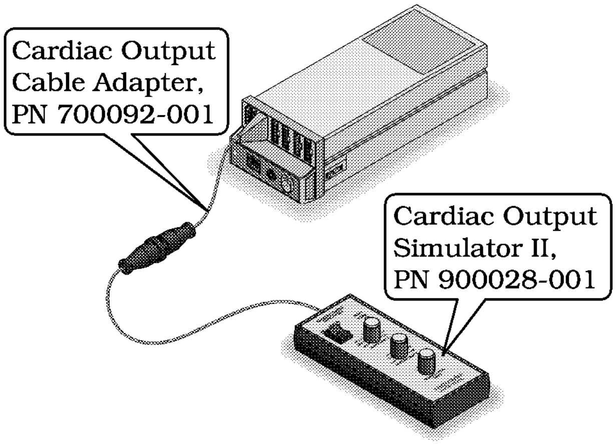
1. Set up the simulator for a 37°C temperature output.
2. Attach a temperature sensor adaptor to the TEMP/CO connector of the Tram module.


Temperature Adapter, PN 402015-001
Patient Simulator, PN MARQ-1
Temperature Simulator Cable, PN 6770031

3. Set the switch on the adaptor to the 400 position.
4. Attach a cable from the SERIES 400 TEMPERATURE OUTPUT connector of simulator to the T1 connector of the temperature sensor adaptor.
5. Observe that a T1 reading appears on the display with reading between 36.6 and 37.4.
6. Move cable from the T1 connector of the temperature sensor adaptor to the T2 connector.
7. Observe that a T2 reading appears on the display with reading between 36.6 and 37.4.
8. Remove the temperature sensor adaptor and temperature cable from the Tram module and the simulator.

## Cardiac Output Test

1. Connect a cardiac output cable adapter to the TEMP/CO connector of the Tram module and connect the CO adaptor to a cardiac output simulator II.


Cardiac Output Cable Adapter, PN 700092-001
Cardiac Output Simulator II, PN 900028-001

2. Set the cardiac output simulator to output the BT (blood temperature) readings in the following table and observe the correct readings on the monitor:

**Table 5-4. Simulator Output Blood Temperature Settings**

| Simulator BT Setting | Monitor BT Reading Range |
|---|---|
| 30.3°C | 30.1 – 30.5 |
| 35.1°C | 34.9 – 35.3 |
| 36.0°C | 35.8 – 36.2 |
| 37.0°C | 36.8 – 37.2 |
| 41.7°C | 41.5 – 41.9 |

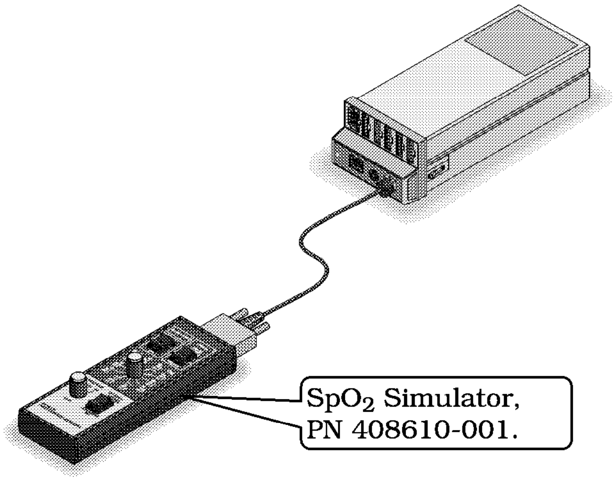
3. Set the cardiac output simulator to output the IT (injectate temperature) readings in the following table and observe the correct readings on the monitor:

**Table 5-5. Simulator Injectate Temperature Settings**

| Simulator BT Setting | Monitor BT Reading Range |
|---|---|
| 0.0°C | –0.3 – +0.3 |
| 8.0°C | 7.7 – 8.3 |
| 15.0°C | 14.7 – 15.3 |
| 24.0°C | 23.7 – 24.3 |
| 29.6°C | 29.3 – 29.9 |

## $SpO_2$ Test

1. Turn the $SpO_2$ simulator power switch OFF.
2. Connect the simulator to the Tram module simulator cable. For Tram X50 modules, use the MEI or Nellcor square-style $SpO_2$ simulator cable, pn 700232-004, and for the Tram X00 modules, use the Ohmeda round-style $SpO_2$ simulator cable, pn 700323-002.



3. Set the simulator as follows:
   - Set the MODE to your type of probe (NELLCOR or OHMEDA).

     **NOTE**
     On the simulator, use the gold-colored values for OHMEDA and the white-colored values for NELLCOR. The OHMEDA values are presented in parentheses in this procedure.

   - Set the $SpO_2$% to 99.
   - Set the PRR to 100 beats/min.
   - Turn the power ON.
4. Verify the following are displayed at the monitor:
   - A sinusoidal waveform with an $SpO_2$ label.
   - An $SpO_2$% reading between 97 – 100% (97 and 102%).
   - A PRR reading between 97 and 103 beats per minute (it might be necessary to turn $SpO_2$ ON).
5. Test the accuracy of these $SPO_2$% settings.

**Table 5-6. Accuracy of $SpO_2$ Settings**

| Simulator Setting | Displayed $SpO_2$ Value |
|---|---|
| 99% (Both types) | 97 – 100% (97 – 102%) |
| 80.3% (84%) | 78 – 82% (81 – 87%) |
| 49.7 (63%) | 48 – 52% (61 – 65%) |

6. Test the accuracy of these PPR settings:

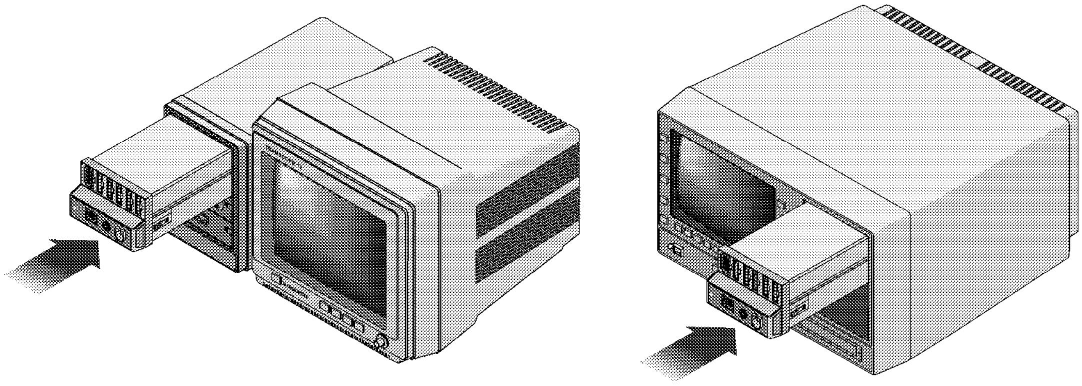
**Table 5-7. Accuracy of PPR Settings**

| Simulator Setting | Displayed PPR Value |
|---|---|
| 70 | 68 – 72 |
| 100 | 97 – 103 |
| 160 | 156 – 164 |

7. Return the simulator to these conditions:
   - Set the $SpO_2$% to 99.
   - Set the PPR to 100 beats/min.
8. Press the NOISE TEST button ON the simulator for 30 seconds.
9. Make sure the monitor still displays an $SpO_2$ value between 97 and 100% (97 and 102%), or an interference detection message is displayed.
10. Set these alarms on the monitor:
    - Set $SpO_2$% LO to 90.
    - Set PPR HI to 150.
11. Set PPR on the simulator to 160.
12. Make sure the PPR value on the monitor flashes, and it sounds an alarm.
13. Return PPR on the simulator to 100.
14. Set $SpO_2$% on the simulator to 80.3% (84%).
15. Make sure the $SpO_2$% value on the monitor flashes, and it sounds an alarm.
16. Turn the simulator OFF.
17. Make sure the monitor shows a CHECK PROBE message.
18. Disconnect the simulator cable from the Tram module.

## NBP Tests

Insert the module in the top slot of a Tram-rac 4 housing or Series 70XX-type.

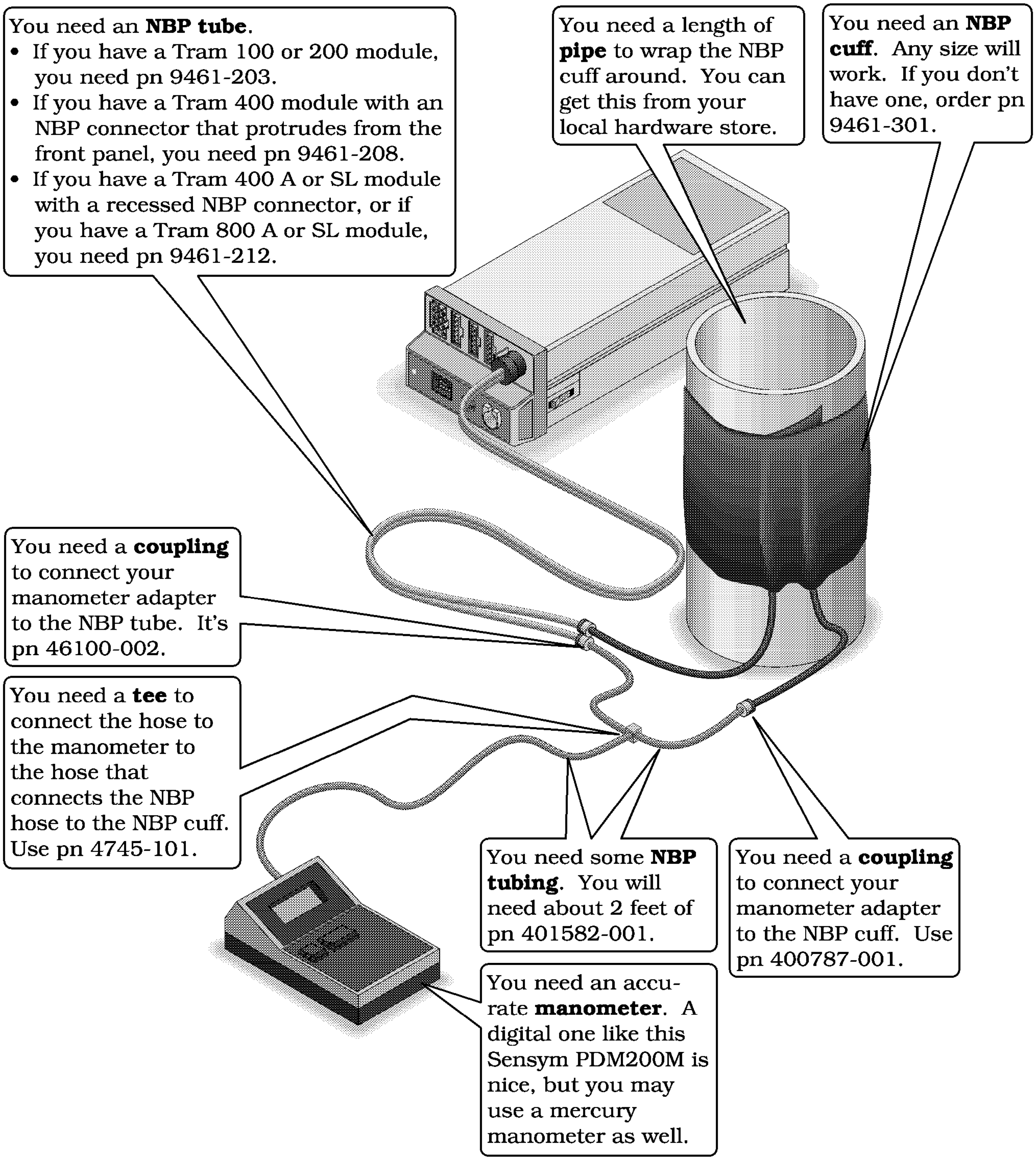


1. Disconnect all parameter cables
2. Apply power to the monitor. If your Tram-rac housing has its own power supply, apply power to it, too.
3. Enure POWER indicator on the Tram module's front panel is turned ON.

There are two different NBP calibration procedures: one for Tram modules used with Tram Critical Care monitors (Tramscope or Solar displays with Tram-rac housings), and one for Tram modules used with Series 70XX-type (7000, 7000RA, 7005, 7010, and 7010RA) monitors.

**WARNING**
When the NBP cuff is used in this procedure, it must be tightly wrapped around a tube. Never put the cuff around your arm during the calibration procedures. If you do put the cuff around your arm during this procedure, you will injure yourself.

1. Connect a manometer and NBP cuff to the NBP connector on the front of the Tram module as shown below.



You need an **NBP tube**.

- If you have a Tram 100 or 200 module, you need pn 9461-203.
- If you have a Tram 400 module with an NBP connector that protrudes from the front panel, you need pn 9461-208.
- If you have a Tram 400 A or SL module with a recessed NBP connector, or if you have a Tram 800 A or SL module, you need pn 9461-212.

You need a length of **pipe** to wrap the NBP cuff around. You can get this from your local hardware store.

You need an **NBP cuff**. Any size will work. If you don't have one, order pn 9461-301.

You need a **coupling** to connect your manometer adapter to the NBP tube. It's pn 46100-002.

You need a **tee** to connect the hose to the manometer to the hose that connects the NBP hose to the NBP cuff. Use pn 4745-101.

You need some **NBP tubing**. You will need about 2 feet of pn 401582-001.

You need a **coupling** to connect your manometer adapter to the NBP cuff. Use pn 400787-001.

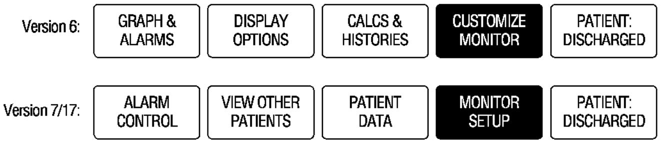
You need an accurate **manometer**. A digital one like this Sensym PDM200M is nice, but you may use a mercury manometer as well.

2. Turn the manometer ON, and set its range switch to the 1000 mmHg setting.

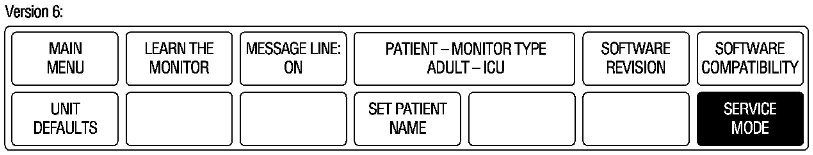
## NBP Test for Tram Critical Care Monitors

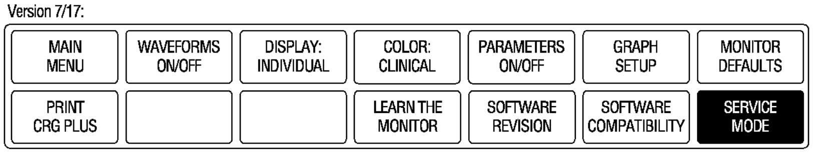
Perform this test if you are using the Tram module with a Tram Critical Care monitor (Tramscope or Solar monitor). This procedure assumes you have either version 6, 7, or 17 software in your Tramscope/Solar display, Tram-rac housing, and Tram module.

1. From the Tramscope display's main menu, rotate the Trim Knob control to highlight CUSTOMIZE MONITOR (with version 6), or MONITOR SETUP (with version 7/17) and then press the Trim Knob control to select it.

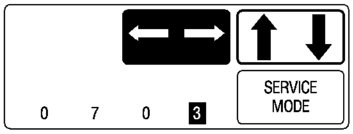

Version 6:
GRAPH & ALARMS
DISPLAY OPTIONS
CALCS & HISTORIES
CUSTOMIZE MONITOR
PATIENT: DISCHARGED
Version 7/17:
ALARM CONTROL
VIEW OTHER PATIENTS
PATIENT DATA
MONITOR SETUP
PATIENT: DISCHARGED

2. Rotate the Trim Knob control to highlight SERVICE MODE, and then press the Trim Knob control to select it.


Version 6:
MAIN MENU
LEARN THE MONITOR
MESSAGE LINE: ON
PATIENT – MONITOR TYPE ADULT – ICU
SOFTWARE REVISION
SOFTWARE COMPATIBILITY
UNIT DEFAULTS
SET PATIENT NAME
SERVICE MODE


Version 7/17:
MAIN MENU
WAVEFORMS ON/OFF
DISPLAY: INDIVIDUAL
COLOR: CLINICAL
PARAMETERS ON/OFF
GRAPH SETUP
MONITOR DEFAULTS
PRINT CRG PLUS
LEARN THE MONITOR
SOFTWARE REVISION
SOFTWARE COMPATIBILITY
SERVICE MODE

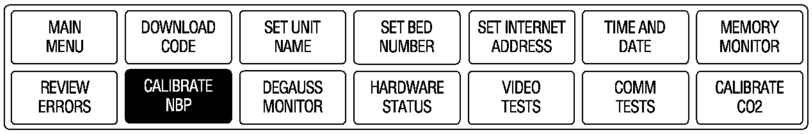
3. You have to enter a password to get into the service mode. The first two digits of the password are the day of the month, and the second two digits are the month. For example, on 7 March, the password would be 0703.
   - Rotate the Trim Knob control to highlight a password digit.
   - Press the Trim Knob control to select the password digit.
   - Rotate the Trim Knob control to change the value of the password digit.
   - Rotate the Trim Knob control to enter the password digit.
   - Repeat the steps above until all of the digits are entered.
   - Rotate the Trim Knob control to hilite SERVICE MODE from the menu.
   - Press the Trim Knob control to enter the service mode.


0 7 0 3
SERVICE MODE

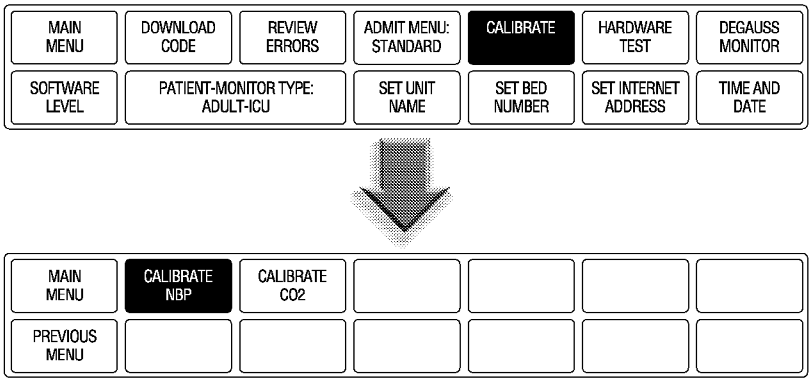
4. If you have version 6 software, rotate the Trim Knob control to highlight CALIBRATE NBP, and then press the Trim Knob control to select it.

   If you have version 7/17 software, rotate the Trim Knob control to highlight CALIBRATE, and press the Trim Knob control to select it. Then rotate the Trim Knob control to highlight CALIBRATE NBP, and press the Trim Knob control to select it.

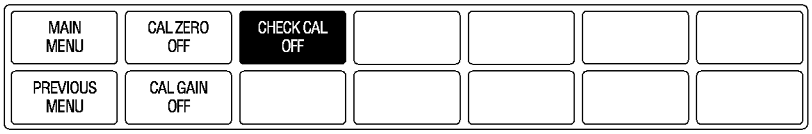
Version 6:


MAIN MENU
DOWNLOAD CODE
SET UNIT NAME
SET BED NUMBER
SET INTERNET ADDRESS
TIME AND DATE
MEMORY MONITOR
REVIEW ERRORS
CALIBRATE NBP
DEGAUSS MONITOR
HARDWARE STATUS
VIDEO TESTS
COMM TESTS
CALIBRATE CO2

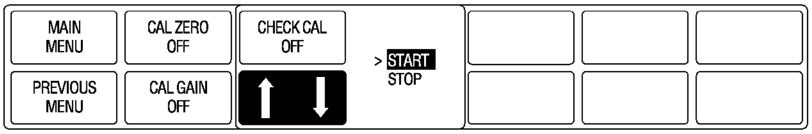
Version 7/17:


MAIN MENU
DOWNLOAD CODE
REVIEW ERRORS
ADMIT MENU: STANDARD
CALIBRATE
HARDWARE TEST
DEGAUSS MONITOR
SOFTWARE LEVEL
PATIENT-MONITOR TYPE: ADULT-ICU
SET UNIT NAME
SET BED NUMBER
SET INTERNET ADDRESS
TIME AND DATE
MAIN MENU
CALIBRATE NBP
CALIBRATE CO2
PREVIOUS MENU

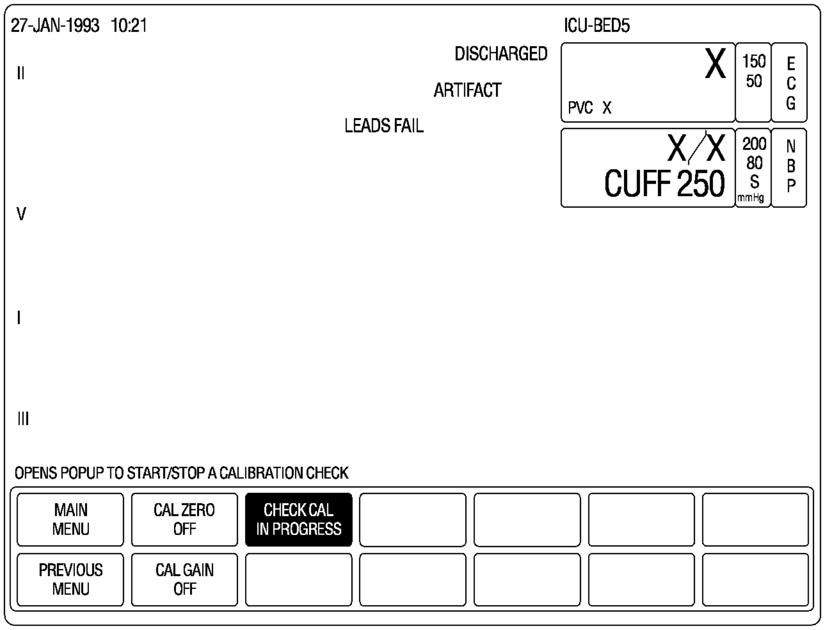
5. Rotate the Trim Knob control to highlight CHECK CAL OFF, and then press the Trim Knob control to select it.


MAIN MENU
CAL ZERO OFF
CHECK CAL OFF
PREVIOUS MENU
CAL GAIN OFF

6. Rotate the Trim Knob control to highlight START, and then press the Trim Knob control to select it.


MAIN MENU
CAL ZERO OFF
CHECK CAL OFF
> START
STOP
PREVIOUS MENU
CAL GAIN OFF

7. The text on the menu item will change from CHECK CAL OFF to CHECK CAL IN PROGRESS. Make sure that the pressure readings (shown as CUFF in the NBP parameter box) on the Tramscope display and manometer are equal (± 1 mmHg) for at least one full minute. If they are not equal, it means that you must calibrate the NBP parameter. Refer to “NBP Calibration” in Chapter 4: “Calibration.”



27-JAN-1993 10:21

ICU-BED5

DISCHARGED

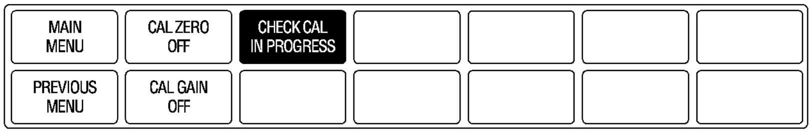
ARTIFACT

LEADS FAIL

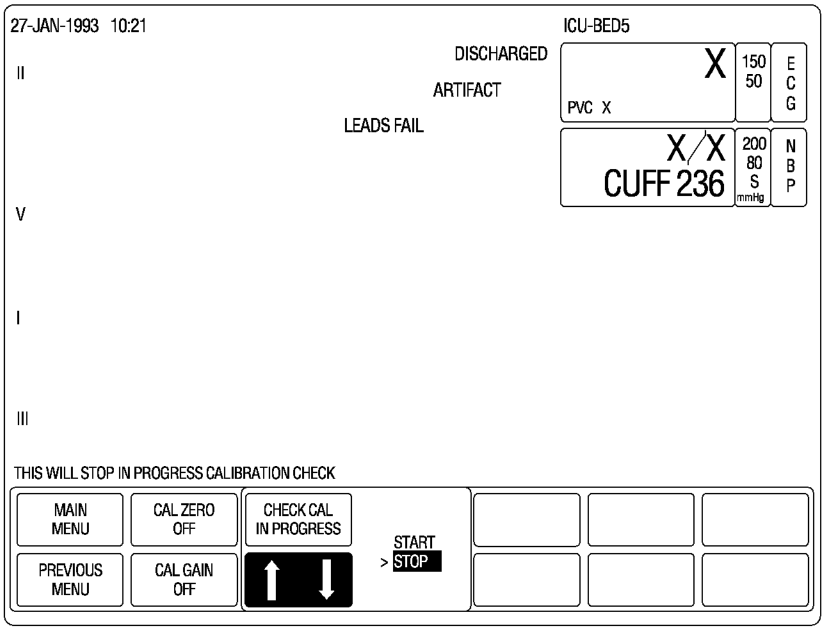
OPENS POPUP TO START/STOP A CALIBRATION CHECK

II
V
I
III
X
PVC X
150
50
E
C
G
X/X
CUFF 250
200
80
S
mmHg
N
B
P
MAIN MENU
CAL ZERO OFF
CHECK CAL IN PROGRESS
PREVIOUS MENU
CAL GAIN OFF

8. Rotate the Trim Knob control to highlight CHECK CAL IN PROGRESS, and then press the Trim Knob control to select it.


MAIN MENU
CAL ZERO OFF
CHECK CAL IN PROGRESS
PREVIOUS MENU
CAL GAIN OFF

9. Rotate the Trim Knob control to highlight STOP, and then press the Trim Knob control to select it. The module then releases pressure in the bulb or cuff.

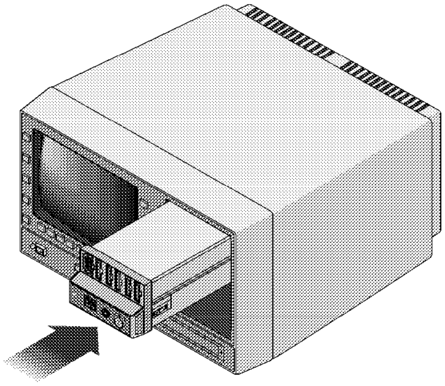

27-JAN-1993 10:21
ICU-BED5
DISCHARGED
ARTIFACT
LEADS FAIL
II
V
I
III
X
PVC X
150
50
ECG
X/X
CUFF 236
200
80
S
mmHg
NBP
MAIN MENU
CAL ZERO OFF
CHECK CAL IN PROGRESS
PREVIOUS MENU
CAL GAIN OFF
START
> STOP

THIS WILL STOP IN PROGRESS CALIBRATION CHECK

This completes the NBP calibration procedure. Remove the cuff and manometer from the Tram module.

## NBP Test for Series 70XX Monitors

You should run this test if you use your Tram module with a Series 70XX-type monitor (Series 7000, 7000RA, 7005, 7010, or 7010RA monitors).

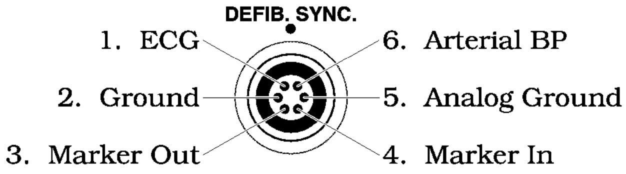


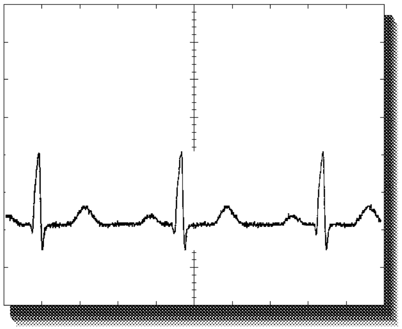
1. Press the SYSTEM key on the monitor.
2. Press the MONITOR SETUP, MONITOR SERVICE, and then CALIBRATE NBP soft keys. Soft keys are the unlabeled keys under the display. The function of each key appears on the display, just above the key.
3. If an NBP cuff is attached to the Tram module, remove it.
4. Press the YES soft key.
5. Press the TEST CAL soft key and verify that the pressure readings on the monitor and manometer are equal (± 1 mmHg) for at least one minute. If they are not equal, it means that you must calibrate NBP (that procedure starts on page 36).
6. Press the TEST CAL soft key to stop the test.
7. Press the CLEAR key.

This completes the NBP calibration procedure. Remove the cuff and manometer from the Tram module.

## DEFIB SYNC Test

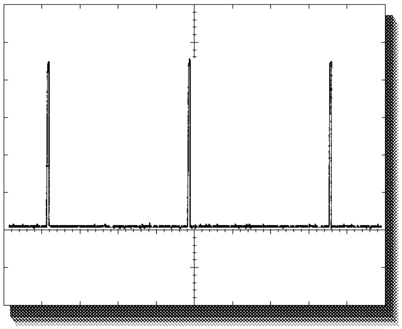
1. Connect an oscilloscope to the DEFIB SYNC connector on the front panel of the Tram module.
2. Test the ECG, Arterial BP, and Marker Out signals from the DEFIB SYNC connector. They should closely resemble the waveforms in the figure below. Note that there are two Marker Out traces shown. The top trace shows the frequency of the pulses; the bottom trace shows the pulse width.

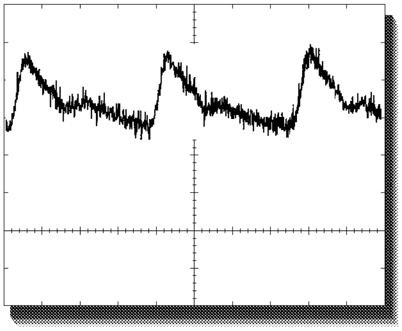




**ECG**
Signal Pin:1
Ground Pin:5
Probe Type:
x10
Time/
Division:0.2S
Volts/
Division:0.5V

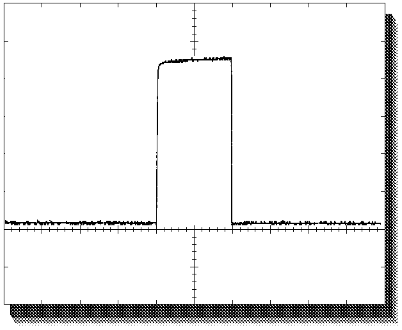
**Marker Out**
Signal Pin:3
Ground Pin:2
Probe Type:
x10
Time/
Division:0.2S
Volts/
Division:1V



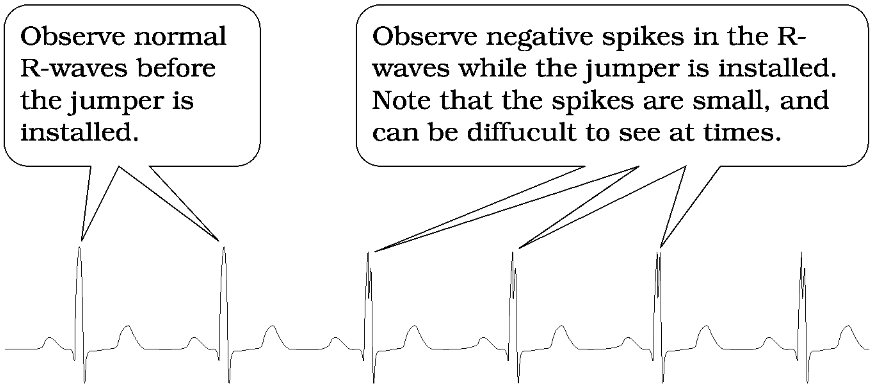


**Arterial BP**
Signal Pin:6
Ground Pin:5
Probe Type:
x10
Time/
Division:0.2S

**Marker Out**
Signal Pin:3
Ground Pin:2
Probe Type:
x10
Time/



3. Attach a jumper between pin 3 (Marker Out) and pin 4 (Marker In) of the DEFIB SYNC connector and observe negative spikes in the R-waves of the displayed ECG waveforms.



Observe normal R-waves before the jumper is installed.

Observe negative spikes in the R-waves while the jumper is installed. Note that the spikes are small, and can be diffucult to see at times.

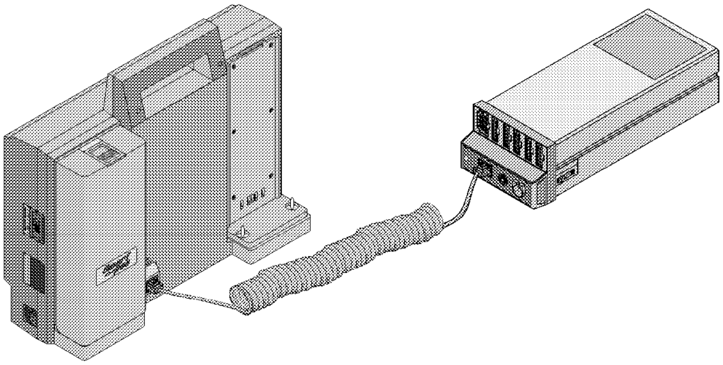
4. Remove the jumper.

## Fan Test

Listen for the fan. The fan should be running whenever the Tram module is installed in a bedside monitor.

## Transport Test

1. Connect the Tram module to a transport display. Make sure there are batteries on the rear of the display, and that the batteries are sufficiently charged.



2. Remove the Tram module from the bedside monitor.
3. Set up simulator like this:
   - Set heart rate to 80 bpm.
   - Set amplitude to 1.0 mV.
4. Observe the following:
   - No error messages are shown on the transport display.
   - The transport display shows ECG lead II, and it is noise-free.
   - The transport display shows a heart rate of 80 ±1 bpm.
   - If the QRS tones are turned ON, an audible tone sounds with each QRS complex.
5. Make sure that you can display all of the available ECG leads.

## Completion

1. Turn all test equipment OFF.
2. Remove all test cabling from the Tram module.

# Domestic Electrical Safety Tests

## Test Frequency

We recommend electrical safety tests be performed:

- upon receipt of the module,
- every six months thereafter, and
- each time the module is open or repaired.

Remember to record the date and results on the "Maintenance/ Repair Log" included at the end of this chapter.

**WARNING**
Failure to perform leakage tests may cause undue equipment failure and possible health hazards. Marquette Electronics, Inc does not in any manner, unless an Equipment Maintenance Contract exists, assume the responsibility for performing this recommended safety test. The sole responsibility rests with the individual or institution using the equipment. Marquette service personnel may, at their discretion, use this procedure as a helpful guide during visits to the equipment site.

### Required Tests

To help you establish a systematic maintenance routine, Marquette Electronics recommends that you perform all safety tests presented in this chapter

These instructions are intended for every module in the system. If the Tram-rac housing does not have its own power supply, it should remain connected to the monitor during the safety tests. Listed below are the safety tests.

- AC Line Voltage Test; This test verifies that the domestic wall outlet supplying power to the equipment is properly wired.
- Ground Continuity Test; This test verifies continuity between all the exposed metal surfaces of the monitor and the ground prong on the mains AC power cord.
- Hi-Pot Tests; These tests are mandatory when a module is opened or repaired.
- Leakage Current Tests; These tests are performed after the hi-pot tests.

If a module under test fails the leakage tests, do not allow the unit to return to service. Call Tech Support for assistance. (Refer to "How to Reach Us" in Chapter 1: "Introduction."

### Test Conditions

All electrical safety test may be performed under normal ambient temperature, humidity, and pressure conditions.

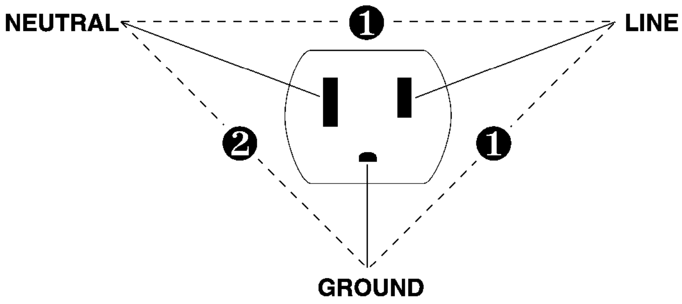
# AC Line Voltage Test

This test verifies that the domestic wall outlet supplying power to the equipment is properly wired. For international wiring tests, refer to the internal standards agencies of that particular country.

## 120 VAC, 50/60 Hz

Use a digital voltmeter to check the voltages of the 120-volt AC wall outlet (dedicated circuit recommended). If the measurements are significantly out of range, have a qualified electrician repair the outlet. The voltage measurements should be as follows:

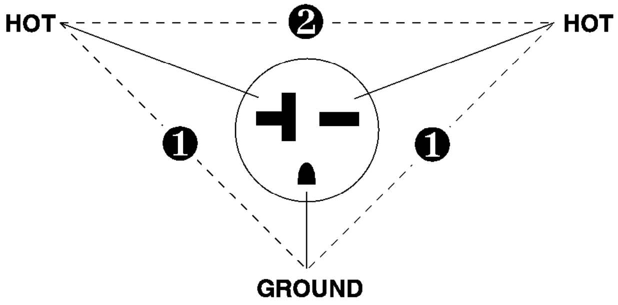
1. 120 VAC (± 10 VAC) between the line contact and neutral and between the line contact and ground.
2. Less than 3 VAC between neutral and ground.



## 240 VAC, 50/60 Hz

Use a digital voltmeter, set to measure at least 300 VAC, to check the voltages of the NEMA 6-20R, AC wall outlet (dedicated circuit recommended). If the measurements are significantly out of range, have a qualified electrician repair the outlet. The voltage measurements should be as follows:

1. 120 VAC (± 10 VAC) between either “hot” contact and ground.
2. 210 to 230 VAC between the two “hot” contacts.



# Ground Continuity Test

This test verifies continuity (less than 100 mΩ resistance) between all the exposed metal surfaces, which have the potential to become energized, and the ground prong on the mains AC power cord. If the metal surfaces are anodized or painted, scrape off a small area in an inconspicuous area for the probe to make contact with the metal.

You will require a digital multimeter (DMM) to check all the metal surfaces of the unit. Make adjustments for any resistance from the test leads.

Do the following steps in the order given.

1. Disconnect each monitor and, if applicable, Tram-rac housing with its own power supply from all power sources. A Tram-rac housing without its own power supply should remain connected to the monitor.
2. Connect the negative lead of the DMM to the ground prong of the power cord plug.
3. Set the DMM to the milli-ohm range.
4. Connect the positive lead of the DMM to any exposed metal surface on the unit under test.
5. The reading should be less than 100 milli-ohms.

   If the readings are not less than 100 milli-ohms, the unit has failed this test.

   - Check for breaks in the power cord or in the internal connections within the monitor.
   - Perform repairs and retest before using the unit on a patient.

# Current Leakage Tests

## Preparation

The leakage current tests are safety tests to ensure that the equipment poses no electrical health hazards. It is recommended after performing the hi-pot tests.

**WARNING**
Failure to perform leakage tests may cause undue equipment failure and possible health hazards. Marquette Electronics, Inc does not in any manner, unless an Equipment Maintenance Contract exists, assume the responsibility for performing this recommended safety test. The sole responsibility rests with the individual or institution using the equipment.

## Required Tools/ Equipment

You will need the special tools and items listed below. Equivalent equipment may be substituted if necessary.

**Table 5-8. Required Tools/Equipment**

| Item | Manufacturer | Part Number |
|---|---|---|
| Leakage current tester<br>120 V (or equivalent)<br>240 V (or equivalent) | MEI | <br>MT-1216-01<br>MT-1216-02 |
| Digital multimeter (DMM) | Fluke | 8060A |
| ECG test body | MEI | 97516-100 |
| $SpO_2$ | MEI | MT-4366 |

**NOTE**
The accuracy of the leakage tests depends on a properly-wired wall outlet. Do not proceed until you verify the integrity of the power source.

## Current Limits

Use the table below to determine the maximum allowable leakage currents. For international leakage limits, refer to the internal standards agencies of that particular country.

**Table 5-9. Maximum Allowable Leakage Currents**

| Test | | Maximum Current |
|---|---|---|
| 1 | Patient-Cable-Leakage-to-Ground<br>Ground closed, normal & reverse polarity | 10 µA for 120 V<br>10 µA for 240 V |
| 2 | Patient-Cable-Leakage-into-Patient Leads<br>Ground closed, normal & reverse polarity | 10 µA for 120 V<br>50 µA for 240 V |

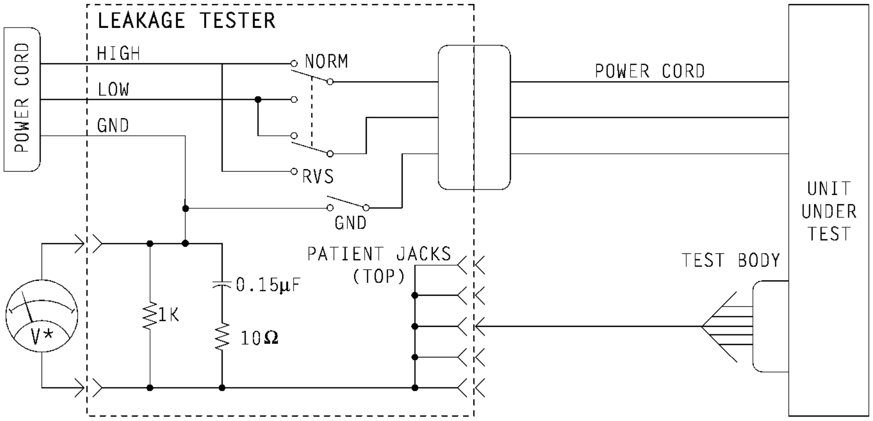
## Patient-Cable-Leakage to-Ground Test

This test checks leakage current from the patient cable connector of the module to ground.

1. Install the module in a a Tram-rac 4 housing or Series 70XX-type monitor.
2. Connect the monitor power cord to the power outlet on the leakage tester.
3. With the power switch of the leakage tester off, connect the power cord of the leakage tester to a correctly wired and properly grounded ac power outlet.
4. Set leakage tester switches as follows:
   a. Set the selector knob to 3.
   b. Set the GND switch to GND OPEN.
   c. Set the polarity switch to NORM.
   d. Set the power switch to OFF.
5. Connect an appropriate test body to the connector of the module.
6. Connect a short length of cable between the test body installed in the last step and the jacks on the top of the leakage tester.
7. Set the leakage tester's power switch to ON.
8. Set the monitor's rear panel power switch to ON.
9. Read the leakage current indicated on the DMM.

If the reading is greater than 10 microamperes (10 millivolts on the DMM), the module fails this test and should be repaired and tested again.

*Partial Schematic Diagram*



1-mV meter reading = 1-µA leakage current

10. Change the leakage tester polarity switch to the RVS position.
11. Read the leakage current indicated on the DMM.

    If the reading is greater than 10 microamperes (10 millivolts on the DMM), your module fails this test and should be repaired and tested again.

12. Change the GND switch to the CLOSED position.
13. Read the leakage current indicated on the DMM.

    If the reading is greater than 10 microamperes (10 millivolts on the DMM), your module fails this test and should be repaired and tested again.

14. Change the leakage tester polarity switch to the RVS position.
15. Read the leakage current indicated on the DMM.

    If the reading is greater than 10 microamperes (10 millivolts on the DMM), your module fails this test and should be repaired and tested again.

16. For Tram X50 modules, repeat steps 4 through 15 with the $SpO_2$ test body int he blue $SpO_2$ connector.
17. Set the power switch of the leakage tester to OFF.

## Patient-Cable-Leakage-into-Patient Leads Test

This tests the patient cable leakage current from a 115 or 220V AC source into the connector of the module.

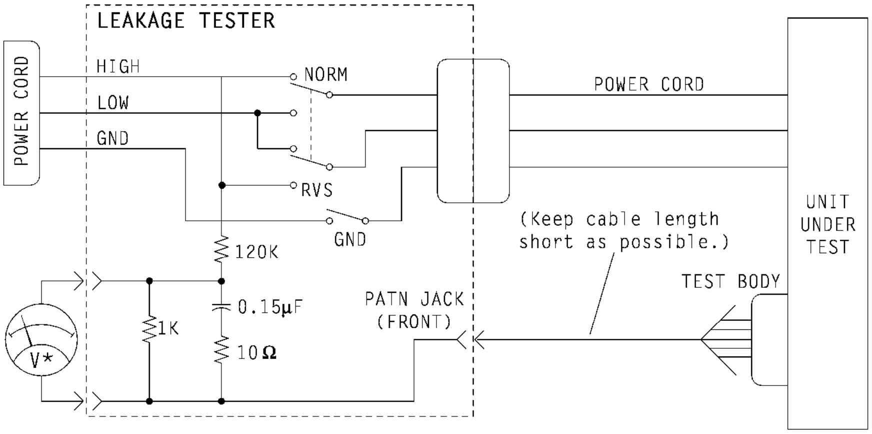
1. Set the leakage tester switches like this:
    a. Set the selector knob to 5.
    b. Leave the GND switch set to CLOSED.
    c. Set the polarity switch to NORM.
2. Disconnect the cable between the leakage tester and the test body, and reconnect it between the test body and the PATN JACK connector on the front panel of the leakage tester.

**WARNING**
The following step will cause high voltage to appear at the PATN JACK on the leakage tester.

3. Set power switch on the leakage tester to ON.
4. Read leakage current indicated on DMM.
    - For 115 V/60 Hz power: 10 microamperes (10 millivolts on the DMM)
    - For 220 V/50 Hz power: 50 microamperes (50 millivolts on the DMM)

If your module fails this test, it should be repaired and tested again.

*Partial Schematic Diagram*


LEAKAGE TESTER
POWER CORD
HIGH
LOW
GND
NORM
RVS
GND
120K
0.15µF
1K
10Ω
V*
PATN JACK (FRONT)
POWER CORD
(Keep cable length short as possible.)
TEST BODY
UNIT UNDER TEST

1-mV meter reading = 1-µA leakage current

5. Change the leakage tester polarity switch to the RVS position.
6. Read the leakage current indicated on the DMM.

   If the reading is greater than the following, your module fails this test and should be repaired and tested again.

   - For 115 V/60 Hz power: 10 microamperes (10 millivolts on the DMM)
   - For 220 V/50 Hz power: 50 microamperes (50 millivolts on the DMM)
7. For Tram X50 modules, repeat steps 1 through 6 with the $SpO_2$ test body int he blue $SpO_2$ connector.

**Completion**

1. Set the power switch on the leakage tester to OFF and disconnect all test equipment from the module.
2. Disconnect the monitor power cord from leakage tester.
3. Disconnect the tester from the power outlet.

# Hi-Pot Tests

## Preparation

Hi-pot (high-potential) tests protect the patient from possible electrical health hazards. They are recommended for any patient-connected devices that are repaired to ensure patient isolation after the repair.

### Test Frequency

This test is required each time a module is opened or repaired.

**WARNING**
Failure to perform hi-pot tests may cause undue equipment failure and possible health hazards. Marquette Electronics, Inc does not in any manner, unless an Equipment Maintenance Contract exists, assume the responsibility for performing this recommended safety test. The sole responsibility rests with the individual or institution using the equipment.

### Required Tools/ Equipment

Equipment required to perform the test is listed below. Equivalent equipment may be substituted if necessary.

**Table 5-10. Required Tools/Equipment**

| Item | Manufacturer | Part Number |
|---|---|---|
| AC/DC hi-pot generator | Hipotronics | AD125 |
| ECG test body | MEI | 97516-100 |
| Hi-pot cable | MEI | 97516-101 |
| Bendix connector (used to make test connector) | MEI | 1866-030 |

## Generator Setup

Follow these steps in the same order in which they are listed.

1. Set up the AC/DC hi-pot generator:
    a. Turn the power switch to ON.
    b. Set the VOLTAGE RANGE selector to MEDIUM.
    c. Set the RAISE VOLTAGE selector to 0 volts.
    d. Set the OUTPUT & CURRENT selector to the 5 mA range.
    e. Allow the unit to warm up for 15 minutes before proceeding with this test.
2. If the module to be tested is installed in a monitor, remove it from the monitor.

### Ground Connection

Connect all of the ground pins at the rear panel connector on the module to the GROUND of the AC/DC hi-pot generator using the hi-pot cable.

1. A grounding test connector must be made to connect all pins at the rear connector of the module together. Use test connector, pn 1886-030, to fabricate a grounding test connector.
2. Securely attach ground clip from AC/DC Hi-Pt Generator to grounding test connector.

### High Voltage Connection

The module parameter determines the test body used. Install ECG test body to connector at the front of the module.

## AC Hi-Pot Test

Perform this test on the ECG input of the Tram module. Never attempt to perform this test on any of the other connectors.

**WARNING**
Never attempt to perform this test on any of the other connectors.

1. Install the ECG test body into the connector of the module.
2. Connect one end of a high voltage lead to the exposed lead of the test body.
3. Connect the other end of the high voltage lead to the AC OUT connector of the AC/DC hi-pot generator.

**WARNING**
In the following step, high voltage appears at the test body.

4. Set the HIGH VOLTAGE switch to ON. The high voltage indicator light should illuminate.

**WARNING**
During test, watch that the analog meter to ensure current never exceeds 1 mA. If it does, the unit has failed the test.

5. Slowly turn the RAISE VOLTAGE selector to 3000 volts.
6. Wait for 10 seconds. If the breakdown warning lamp or buzzer activate before the time expires, then the unit has failed the test.
7. Slowly turn the RAISE VOLTAGE selector to 0 volts.
8. Set the HIGH VOLTAGE switch to OFF. The high voltage indicator should turn off.
9. If your module fails this test, make the necessary repairs and test it again.
10. Perform the DC hi-pot test.

## DC Hi-Pot Test

The following procedure should only be performed on the ECG connector. Follow these steps in the order listed.

1. Set the AC/DC hi-pot generator OUTPUT & CURRENT selector to the x 100 DC range.
2. Remove the high voltage lead from the AC OUT connector and connect it to DC OUT connector.

**WARNING**
In the following step, high voltage appears at the test body.

3. Set the HIGH VOLTAGE switch to ON. The high voltage indicator should glow.
4. Slowly turn the RAISE VOLTAGE selector to 6000V dc.
5. Wait for 1 second. If the breakdown warning lamp or buzzer activates before the time expires, then the unit has failed the test.
6. Slowly turn the RAISE VOLTAGE selector to 0 volts.
7. Set the HIGH VOLTAGE switch to OFF. The high voltage indicator should turn off.
8. If your Tram module passed the test, disconnect all cables and perform the Current Leakage Tests, listed earlier in this chapter.
9. If your Tram module failed the test, make the necessary repairs and test it again.

# Repair Log/PM Inspection Form

**Unit Serial Number:**

**Institution Name:**

| Date | Maintenance/Repair | Technician |
|---|---|---|
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# Tram 100 - 850 A/SL Modules

**MPMFRM-002D**
31 JUL 1995

## Preventive Maintenance Inspection Form

**(See Service Manual p/n 404422-001 Tram 100 - 600, p/n 404422-065 Tram 100 - 850 A and SL for Details)**

Customer ______________________ Customer Number ____________ Date ________

FE ________________ FE ID ______ Call Number ____________________________

Equipment Serial Number ____________ Software Revision _________________________

**Module Type**

| | | |
|---|---|---|
| ☐ Tram 100 | ☐ Tram 200 | ☐ Tram 250 |
| ☐ Tram 300 | ☐ Tram 400 | ☐ Tram 450 |
| ☐ Tram 500 | ☐ Tram 600 | ☐ Tram 650 |
| ☐ Tram 800 | ☐ Tram 850 | |
| ☐ "A" Series | ☐ "SL" Series | |

**Tools Required**

| | | |
|---|---|---|
| Leakage tester | Multimeter | Oscilloscope |
| CO simulator II | Marq1 simulator | Manometer |
| NIBP cuff | $SpO_2$ simulator | Nicolay adapter cables |
| Standard hand tools | Anti-static mat and strap | |

**Visual Inspection**

Inspect the following for excess wear and /or any visual signs of damage

| | | |
|---|---|---|
| ☐ General | ☐ Latches | ☐ Connectors |
| ☐ Cable insulation | ☐ Reseat socketed components / connectors | |

**Calibration**

☐ NIBP

**Electrical Safety Tests**

☐ Customer will perform Electrical Safety tests

| | | Open | | Closed | |
|---|---|---|---|---|---|
| | | Normal | Reversed | Normal | Reversed |
| **ECG** | Patient Source Risk leakage (<10μA) | ____μA | ____μA | ____μA | ____μA |
| | Patient Sink Risk leakage (<10μA without patient cable) | N/A | N/A | ____μA | ____μA |
| **$SpO_2$** (for X50 series modules only) | Patient Source Risk leakage (<10μA) | ____μA | ____μA | ____μA | ____μA |
| | Patient Sink Risk leakage (<10μA without patient cable) | N/A | N/A | ____μA | ____μA |

**Checkout Procedure**

**ECG**

| | | |
|---|---|---|
| ☐ Rate (±1) | ☐ All leads noise free | ☐ Pace |
| ☐ Leads fail | ☐ Amplitude | ☐ 3 Lead(A and SL Series) |

**RESP**

Base line of 750Ω - ΔR 0.5Ω - 30 breaths per minute

| | |
|---|---|
| ☐ Rate lead II (± 2) | ☐ Noise free lead II |
| ☐ Rate lead I (± 2) | ☐ Noise free lead I |

**BP**

(2% or ±1mmHg whichever is greater)

| | | |
|---|---|---|
| ☐ Static BP1 | ☐ Dynamic BP1 | ☐ Noise free BP1 |
| ☐ Static BP2 | ☐ Dynamic BP2 | ☐ Noise free BP2 |
| ☐ Static BP3 | ☐ Dynamic BP3 | ☐ Noise free BP3 |
| ☐ Static BP4 | ☐ Dynamic BP4 | ☐ Noise free BP4 |

# Tram 100 - 850 A/SL Modules

**MPMFRM-002D**
Page 2

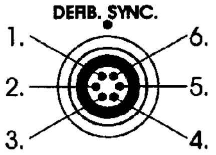
## Checkout Procedure Cont.

**TEMP / CO** The temperature tolerance for all Tram 100-850 A and SL Series modules is ±0.1°C. Tolerances for Tram 100-600 modules are specified below.
[☐ T1 ←→ ☐ T2] (YSI 400, 1% or ±0.3°C whichever is greater)
☐ BT range (± 0.2°C) ☐ IT range (± 0.3°C)

**$SpO_2$** ☐ %$SpO_2$ range (90 - 100, 2.5%), (80 - 89.9, 3.1%), (60 - 79.9, 3.4%)
☐ PPR range (2.7%) ☐ Noise

**NIBP** ☐ Pump (Inflate an Adult Cuff with the bladder folded in half in <30 Sec.)
☐ Leak (<1mmHg per 4 Sec.) ☐ Static (±1 mmHg)

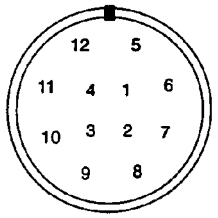
**Analog Output** Use Pin 2 for Marker Out ground and Pin 5 for Analog ground



☐ Pin 1 ECG ☐ Pin 6 Arterial BP ☐ Pin 3 Defib Sync
☐ Marker In (Short Pin 3 to Pin 4 Look for negative pulse on the R wave.)

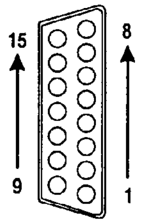
To test Analog Output from the rear connector of a Tram 100 - 800 module check the following waveforms at a Tram RAC.

Pin 8 Ground



Rac 3 / Rac 4

Pin 1 Ground



Rac 4A

| | | |
|---|---|---|
| ☐ ECG II | Pin 1 | Pin 9 |
| ☐ Trace 1 | Pin 2 | Pin 2 |
| ☐ ECG V | Pin 3 | Pin 10 |
| ☐ ART (or BP1) | Pin 4 | Pin 5 |
| ☐ BP 2 (or $SpO_2$ Wave) | Pin 5 | Pin 13 |
| ☐ BP 3 (or $SpO_2$ Value) | Pin 6 | Pin 3 |
| ☐ BP 4 (or Resp) | Pin 7 | Pin 11 |

**General** ☐ Transport test ☐ No LCD error messages
☐ Fan

## Comments

Please comment on any other environmental conditions (Static, Temperature, AC Power, Etc..) that may affect operation or reliability.

______________________________________________

______________________________________________

Briefly describe all repairs / adjustments made and list all parts replaced.

______________________________________________

______________________________________________

______________________________________________

Customer Signature ____________________ FE Signature ____________________

Marquette Electronics, Inc Service and Supplies Division Jupiter,FL 33468-9100

# 6 CONNECTIONS

**External Connectors ........................................................... 6-2**
Blood Pressure Connector ........................................................... 6-2
DEFIB SYNC Signals ........................................................... 6-3
Display Connector ........................................................... 6-4
ECG/RESP Connector ........................................................... 6-5
Rear Connector ........................................................... 6-5
MEI/Nellcor $SpO_2$ Connector ........................................................... 6-7
Ohmeda $SpO_2$ Connector ........................................................... 6-8
TEMP/CO Connector ........................................................... 6-9

# External Connectors

Pin-by-pin descriptions and the signal names for each connector on the front panel and rear of the module are described in this section. Each module uses a "bristle brush" connector to interface to the backplane of the Tram-rac 4 housing or Series 70XX-type monitor (Series 7000, 7000RA, 7005, 7010, or 7010RA) monitor.

## Blood Pressure Connector

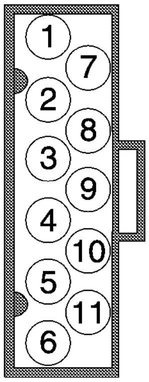
Invasive blood pressure transducers connect to the Tram modules at the BP connectors. The BP connectors are all functionally the same, so the following information applies to all Tram module BP connectors.

If you want to use your existing blood pressure cables and transducers with the Tram modules, but they use different connectors, we offer these termination kits:

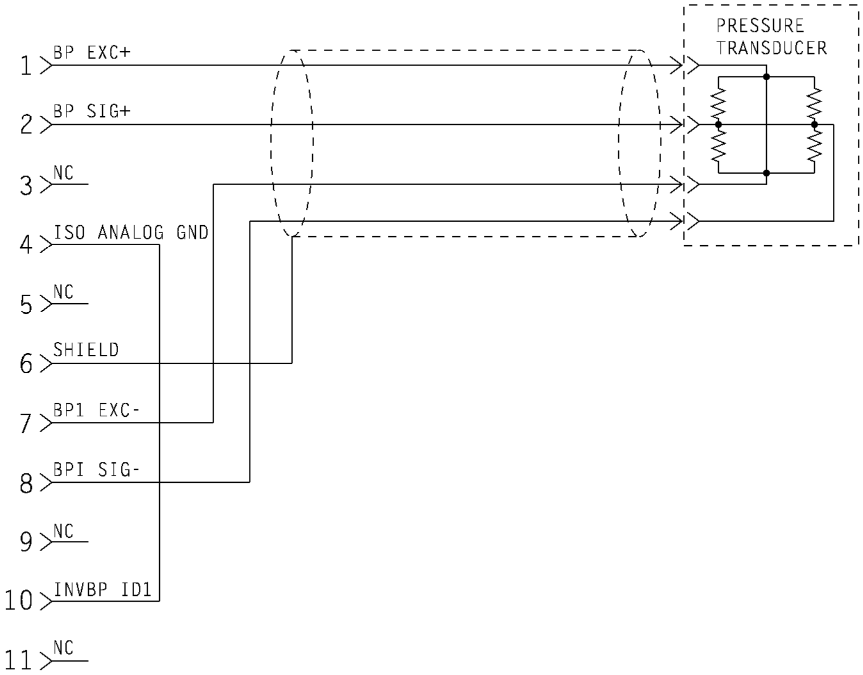
- Abbott Transpac II cables use pn 700074-001
- Abbott Transpac III cables use pn 700075-001
- American Edwards cables use pn 700076-001
- Spectramed cables use pn 700077-001
- Utah cables use pn 700078-002

Tram X00 Modules/Eagle Monitor Termination Instructions for BP, CO, and TEMP Cables, pn 403799-016, describes how to terminate these cables.

**Table 6-1. BP Front Connector**

| Pin | Name | Type | |
|---|---|---|---|
| 1 | BP_EXC+ | Positive excitation voltage (output) |  <br>**Front View of Red-Colored BP Connector** |
| 2 | BP_SIGNAL+ | Positive analog pressure signal from transducer | |
| 3 | NC | | |
| 4 | ISO_ANALOG_GND | Isolated analog ground reference | |
| 5 | NC | | |
| 6 | SHIELD | Cable shield | |
| 7 | BP_EXC– | Negative excitation voltage (output) | |
| 8 | BP_SIG– | Negative analog pressure signal from transducer | |
| 9 | NC | | |
| 10 | INVBP_ID | When you connect this pin to ISO ANALOG GND (pin 4), the monitor show the BP trace for this connector | |
| 11 | NC | | |

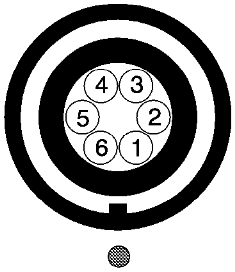
The schematic diagram of the blood pressure probe sensor is presented below.



## DEFIB SYNC Signals

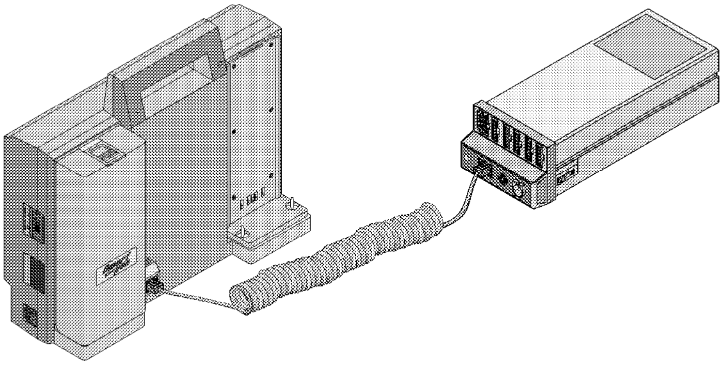
The DEFIB SYNC connector carries signals for interfacing with a defibrillator. It also has analog output signals for ECG traces. If you need to connect a defibrillator with the module, a 15-foot defibrillator cable, pn 403936-001, is available. It has a DEFIB SYNC connector on one end and it is unterminated at the other end.

**Table 6-2. DEFIG SYNC Connector**

| Pin | Name | Description | |
|---|---|---|---|
| 1 | ECG | An ECG x1000 analog output for the top displayed ECG trace |  <br>**Front View of Module** |
| 2 | GND | Digital ground reference for MARKER IN and MARKER OUT | |
| 3 | MARKER_OUT | This normally low output goes positive on the ECG R wave. It is used by some defibrillators to avoid firing during the T-wave. Jumpers on the module processor PCB, pn 800210, select the amplitude (5V or 15V) and pulse width (10 mS or 100 mS) are selectable by the software available in the host monitor menu. See Chapter 4: “Calibration” for details. | |
| 4 | MARKER_IN | On positive edges of this input, the monitor and DDW display a marker on the ECG waveform. It is usually used to record the time of defibrillation. | |
| 5 | ANALOG_GND | Analog ground reference for the ECG and BP outputs. | |
| 6 | BP | A 10mV/mm Hg blood pressure analog output for the top ART trace. If there is no ART trace, it is for the BP1 trace. If the signal is not zeroed, this pin outputs a 60-Hz, 1 Vp-p triangle wave. | |

## Display Connector

The DISPLAY connector carries communication and power signals between the Tram module and a transport display. Note that the Tram module must be connected to the connector on the rear of the transport display. If you plug it into one of the side connectors, a large COMMUNICATION FAILURE message will appear.

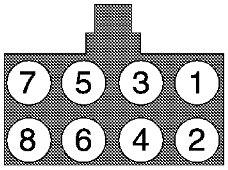


You can use any of these cables to connect your Tram module to a transport display:

**Table 6-3. Display Cables**

| Part Number | Length (Feet) | Length (Meters) |
|---|---|---|
| 403495-001 | 10 | 3 |
| 403496-001 | 15 | 4.6 |
| 406468-002 | 25 | 7.6 |
| 406468-001 | 40 | 12.2 |

**Table 6-4. ECG/RESP Connector**

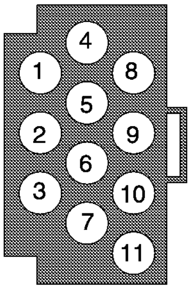
| Pin | Name | Description | |
|---|---|---|---|
| 1 | DLK_TXD+ | RS422 output[1] |  |
| 2 | DLK_TXD– | RS422 output[1] | |
| 3 | DLK_RXD+ | RS422 input[1] | |
| 4 | DLK_RXD– | RS422 input[1] | |
| 5 | PWRRTN | Power Bus and +16.5V ground | |
| 6 | SENSE_OUT | The transport display connects this signal to PWRRTN to turn the Tram module on. | |
| 7 | +16.5V | A 16.5-volt output that powers the transport display when you install the Tram module in a monitor. | |
| 8 | PWRBUS | A 10 to 16.75-volt power input from the transport display. | **Front View of Module** |

[1] NOTE: 38.4k b/s, 8 bit, no parity, 1 stop bit.

## ECG/RESP Connector

ECG patient cables attach to the ECG/RESP connector. In addition to the ECG leadwire, the signals on this connector include a 52.6-kHz respiration carrier.

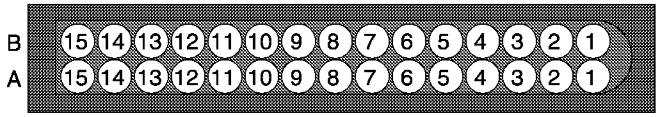
**Table 6-5. ECG/RESP Connector**

| Pin | Name | Description | |
|---|---|---|---|
| 1 | RA | Right arm limb leadwire |  <br>**Front View of Green-Colored ECG Connector** |
| 2 | V2 | V2 chest leadwire | |
| 3 | V3 | V3 chest leadwire | |
| 4 | LA | Left arm limb leadwire | |
| 5 | RL | Right leg limb leadwire | |
| 6 | V/V1 | V (during 3 or 5-leadwire use) or<br>V1 (during 10-leadwire use) for chest leadwire | |
| 7 | V4 | V4 chest leadwire | |
| 8 | LL | Left leg limb leadwire | |
| 9 | V6 | V6 chest leadwire | |
| 10 | V5 | V5 chest leadwire | |
| 11 | SHIELD | Cable shield | |

## Rear Connector

Series 7XXX monitors and Tram-rac housings connect to the Tram module at the MONITOR connector. This is the only connector on the Tram module's rear panel. The MONITOR connector carries power, communication, and analog output signals between the Tram module and a monitor.

**Table 6-6. Rear Module Connector**



**Rear View of Module**

| Pin | Name | Description |
|---|---|---|
| A1 | AGND | Non-isolated analog ground reference |
| A2 | XMIT_EN* | When installed in a Tram-rac housing, the Tram module asserts this CMOS output signal to enable Tram-net communication drivers in the Tram-rac housing. When installed in a Series 7XXX monitor, the Tram module asserts this signal whenever the monitor asserts MOD_ENABLE (on pin 2B) high. |
| A3 | SYNC_ECG_RTN | Ground reference for SYNC ECG on pin 4A. |
| A4 | SYNC_ECG | ECG x10 analog output for the top displayed ECG trace[1] |
| A5 | MOD DATA CLK* | Clock input for synchronous shift register communications with a Series 7XXX monitor. Toggles to clock data to a monitor (across MOD DATA OUT) or from a monitor (across MOD DATA IN). This signal toggles 32 times and then goes high to disable Tram module communications while reading from other modules. |
| A6 | MOD_LOAD_DATA_IN* | Module data input. A CMOS signal used with synchronous shift register communication from Series 7XXX monitor, and with Tram-net communication from Tram-rac housings. |
| A7 | MOD_DATA_OUT* | Module data output. A CMOS signal used with synchronous shift register communication to Series 7XXX monitor, and with Tram-net communication to Tram-rac housings. |

**Table 6-6. Rear Module Connector**

| | | |
|---|---|---|
| A8 | MOD_DATA_LCH* | Synchronous shift register communication latch input from Series 70XX monitor. Goes high to signal to the module that it should latch onto the last 32 bits of data sent across MOD DATA IN. |
| A9 | BP3 | 10 mV/mmHg analog output for BP3 blood pressure trace; outputs $SpO_2$ value x 10 mV if BP3 isn't cabled; outputs buzz[1] if BP3 is not zeroed |
| A10 | NC | |
| A11 | GND | Non-isolated digital ground reference |
| A12 | BKPLANE_ID | A +5-volt input, supplied only by Tram-rac housings with Tram-net communications. |
| A13 | NC | |
| A14 | NC | |
| A15 | AGND | Non-isolated analog ground reference |
| B1 | ART_BP | 10 mV/mmHg analog output for top ART blood pressure trace; outputs BP1 trace if no ART trace is displayed; outputs buzz† if ART/BP1 is not zeroed. |
| B2 | MOD_ENABLE | An input that the 70XX monitor asserts to enable synchronous serial shift register communication with the Tram module. |
| B3 | BP2 | 10 mV/mmHg analog output for BP2 blood pressure trace; outputs $SpO_2$ trace if BP2 is not cabled; outputs buzz[1] if BP2 is not zeroed |
| B4 | +16.5V | A 16.5-volt input that powers the Tram module (and, if connected, the transport display) |
| B5 | PWRBUS | 16.75-volt power input |
| B6 | TRC2/ECGI | ECG x1000 analog output for lead II. If lead II fails, this signal reverts to buzz[1] |
| B7 | TRC1/ECGI | ECG x1000 analog output for the top displayed ECG trace. This signal reverts to buzz[1] during leads fail condition |
| B8 | ECGV | ECG x1000 analog output for lead V. If lead V fails, this signal reverts to buzz[1] |
| B9 | NC | |
| B10 | BP4 | 10mV/mmHg analog output for BP4 blood pressure trace; outputs RESP waveform (without markers) if BP4 is not cabled; outputs buzz[1] if BP4 is not zeroed |
| B11 | GND | Non-isolated digital ground reference |
| B12 | +5V | A +5-volt input, used to determine that the Tram module is installed in a monitor. |
| B13 | NC | |
| B14 | NC | |
| B15 | AGND | Non-isolated analog ground reference |

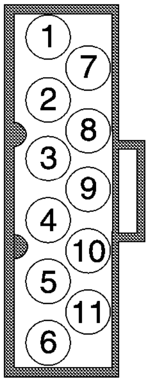
[1] NOTE: Buzz is a 60-Hz, 1-volt peak-to-peak triangle waveform centered around 0 volts. It is not perfectly shaped and only indicates the trace is in a failed condition.

## MEI/Nellcor $SpO_2$ Connector

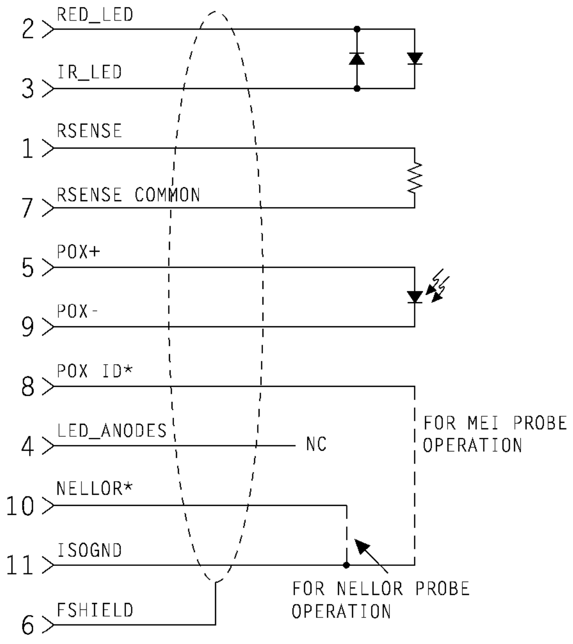
There are two different types of connectors used for collection of $SpO_2$ data.

Nellcor-style and MEI, non-invasive pulse oximetry probes connect to the Tram X50 module with the square-style $SpO_2$ connector. This connector carries the red and infrared light source drive outputs and the photodetector and probe type inputs.

**Table 6-7. $SpO_2$ Connector**

| Pin | Name | Description | |
|---|---|---|---|
| 1 | RSENSE | Probe characteristics ID resistor measurement |  |
| 2 | RED_LED | Red LED cathode (RED LED source) | |
| 3 | IR_LED | Infrared light source cathode (Infrared LED source) | |
| 4 | LED_ANODES | NC | |
| 5 | POX+ | Photodetector anode | |
| 6 | FSHIELD | Cable shield | |
| 7 | RSENSE COMMON | Common return for RSENSE signal | |
| 8 | POX_ID* | Tied to ISOGND for MEI probe identification | |
| 9 | POX– | Photodetector cathode | |
| 10 | NELLCOR* | Tied to ISOGND for Nellcor probe identification | **Front View Blue-Colored $SpO_2$ Connector** |
| 11 | ISOGND | Ground reference for PRB_SENSE and NELLCOR* signals | |

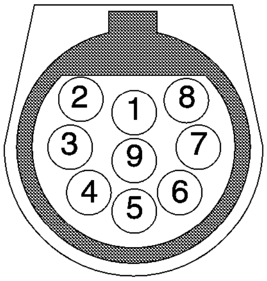
The schematic diagram of the MEI/Nellcor probe sensor is presented below.


2 RED_LED
3 IR_LED
1 RSENSE
7 RSENSE COMMON
5 POX+
9 POX-
8 POX ID*
4 LED_ANODES
NC
10 NELLOR*
11 ISOGND
6 FSHIELD
FOR MEI PROBE OPERATION
FOR NELLOR PROBE OPERATION

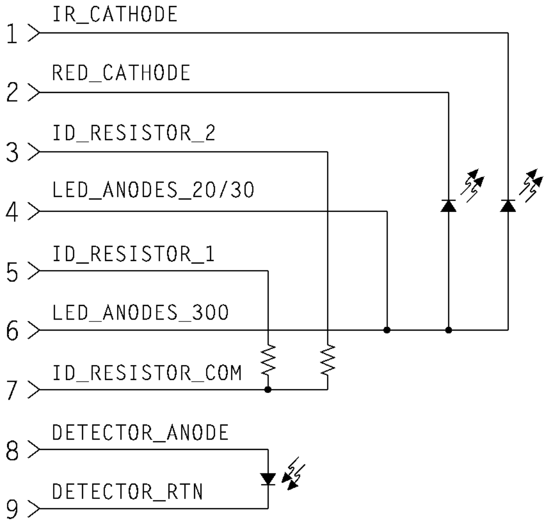
## Ohmeda $SpO_2$ Connector

Ohmeda-style, non-invasive pulse oximetry probes connect to the Tram X50 modules with the round-style SpO2 connector. This connector carries the red and infrared light source drive outputs and the photodetector and probe type inputs.

**Table 6-8. $SpO_2$ Connector**

| Pin | Name | Description | |
|---|---|---|---|
| 1 | IR_CATHODE | Infrared light source cathode. A 5-volt output, with a 33% duty cycle at 400 Hz for 50-Hz power, or at 480 Hz for 60-Hz power. |  **Front View**<br>**White-Colored**<br>**$SpO_2$ Conductor** |
| 2 | RED_CATHODE | Red light source cathode. A 5-volt output, with a 33% duty cycle at 400 Hz for 50-Hz power, or at 480 Hz for 60-Hz power. | |
| 3 | ID_RESISTOR_2 | Probe type identification resistor 2 | |
| 4 | LED_ANODE_20/30 | Light source anode for type 20 and 30 probes. Used as a return for IR_CATHODE and RED CATHODE. | |
| 5 | ID_RESISTOR_1 | Probe type identification resistor 1 | |
| 6 | LED_ANODES_300 | Light source anode for type 300 probes. Used as a return for IR_CATHODE and RED CATHODE. | |
| 7 | ID_RESISTOR_COM | Probe type identification resistor common | |
| 8 | DETECTOR_ANODE | Photodetector anode | |
| 9 | DETECTOR_RTN | Photodetector cathode | |

The schematic diagram of the Ohmeda probe sensor is presented below.

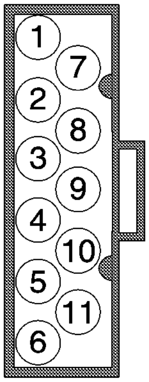

1
IR_CATHODE
2
RED_CATHODE
3
ID_RESISTOR_2
4
LED_ANODES_20/30
5
ID_RESISTOR_1
6
LED_ANODES_300
7
ID_RESISTOR_COM
8
DETECTOR_ANODE
9
DETECTOR_RTN

## TEMP/CO Connector

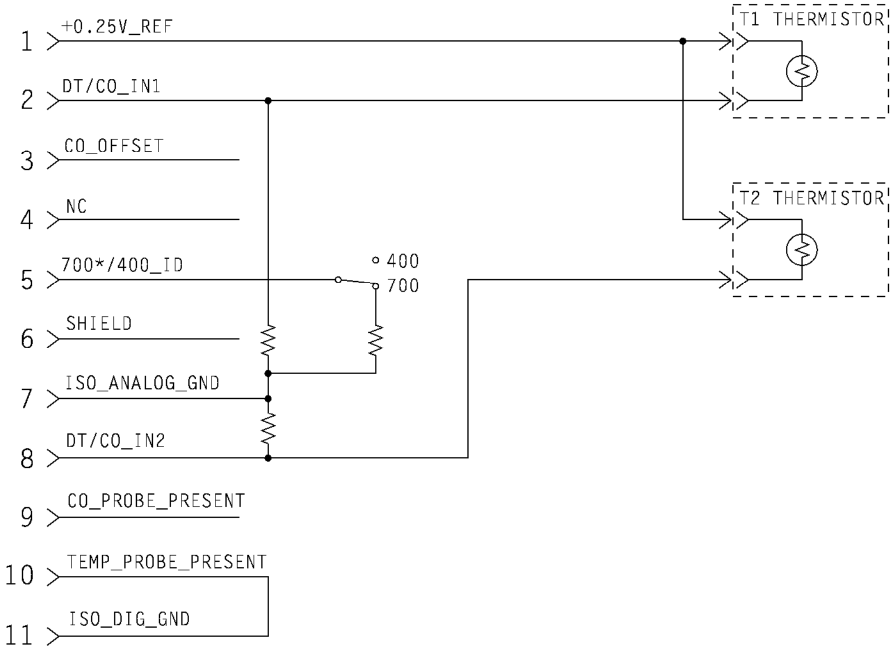
Thermistors and cardiac output probes connect to the Tram module at the TEMP/CO connector.

If you have existing temperature or cardiac output cables, we offer termination kits so you can use the cables with your Tram module. Terminate existing cardiac output cables with pn 404859-004. Terminate existing temperature cables with pn 404859-003. Tram X00 Modules/Eagle Monitor Termination Instructions for BP, CO, and TEMP Cables, pn 403799-016, describes how to terminate these cables.

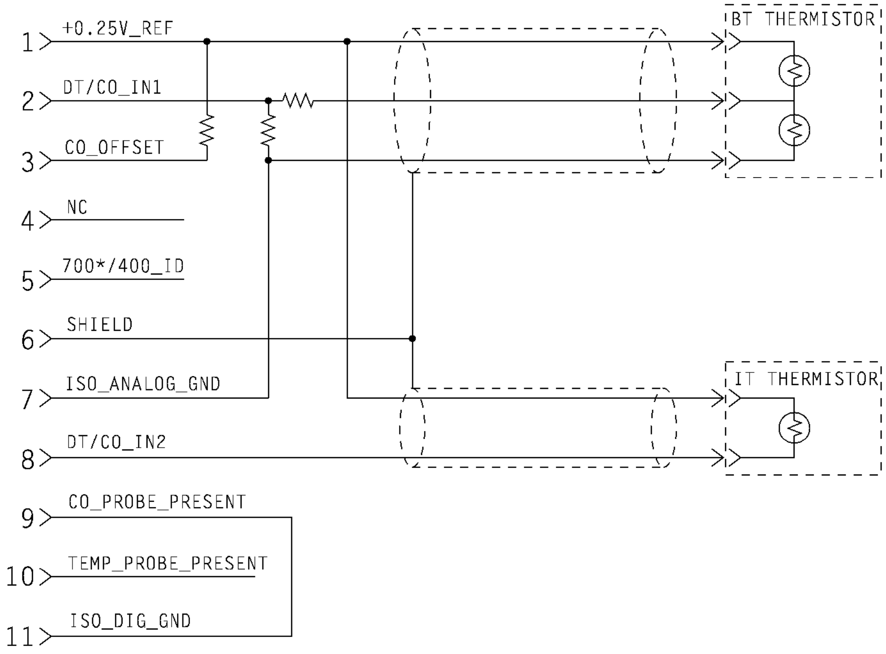
**Table 6-9. CO Front Connector**

| Pin | Name | Type | |
|---|---|---|---|
| 1 | 0.25VD REF | A stable +0.25-volt reference output for the thermistors |  <br>**Front View of Brown-Colored TEMP/CO Connector** |
| 2 | DT/CO IN1 | Channel 1 input | |
| 3 | CO_OFFSET | Catheter offset reference voltage | |
| 4 | NC | | |
| 5 | 700*/400ID | The TEMP cable connects this input to ISO_DIG_GND when YSI series 700 thermistors are used, and leaves it floating when YSI series 400 thermistors are used | |
| 6 | SHIELD | Cable shields are connected here | |
| 7 | ISO_ANALOG_GND | Isolated analog ground reference | |
| 8 | DT/CO IN2 | Channel 2 input | |
| 9 | CO_PROBE_PRESENT | CO cables connect this input to ISO_DIG_GND to show that they are connected. | |
| 10 | TEMP_PROBE_PRESENT | TEMP cables connect this input to ISO_DIG_GND to show that they are connected. | |
| 11 | ISO_DIG_GND | Isolated digital ground | |

**The schematic diagram of the typical TEMP cable/thermistor schematic diagram is presented below.**


1 +0.25V_REF
2 DT/CO_IN1
3 CO_OFFSET
4 NC
5 700*/400_ID
6 SHIELD
7 ISO_ANALOG_GND
8 DT/CO_IN2
9 CO_PROBE_PRESENT
10 TEMP_PROBE_PRESENT
11 ISO_DIG_GND
400
700
T1 THERMISTOR
T2 THERMISTOR

**The schematic diagram of the typical CO cable/thermistor schematic diagram schematic diagram is presented below.**


1 +0.25V_REF
2 DT/CO_IN1
3 CO_OFFSET
4 NC
5 700*/400_ID
6 SHIELD
7 ISO_ANALOG_GND
8 DT/CO_IN2
9 CO_PROBE_PRESENT
10 TEMP_PROBE_PRESENT
11 ISO_DIG_GND
BT THERMISTOR
IT THERMISTOR

# 7

# TRAM 100A MODULE
# PN 408000

**Assembly Configurations** ........................................................7-2

**Exploded View PN 408000C** ....................................................7-3

**Schematic Diagram PN 408000C** ..............................................7-5

**Parts List PN 408000C** ...............................................................7-7

**Revisions Assemblies** ..................................................................7-9

# General

## Circuit Boards

Details about the circuit boards contained in the Tram 100A are discussed in later chapters arranged by part number.

**Table 7-1. Circuit Board Overview**

| Module Type | Upper Level | Leadwire Configuration | DAS Module | Acquisition Processor PCB | Module Processor PCB |
|---|---|---|---|---|---|
| Tram 100A | 40800-0XX | 5-Leadwire | 408134-001 | 800330-005 | 800210-005 |

## Tram 100A Configurations

Marquette manufactures 16 different configurations of this assembly at the time of this writing. The configurations differ in the power frequency, number of ECG leadwires, the type of labelling, and the units of measure used. The table below lists the available configurations.

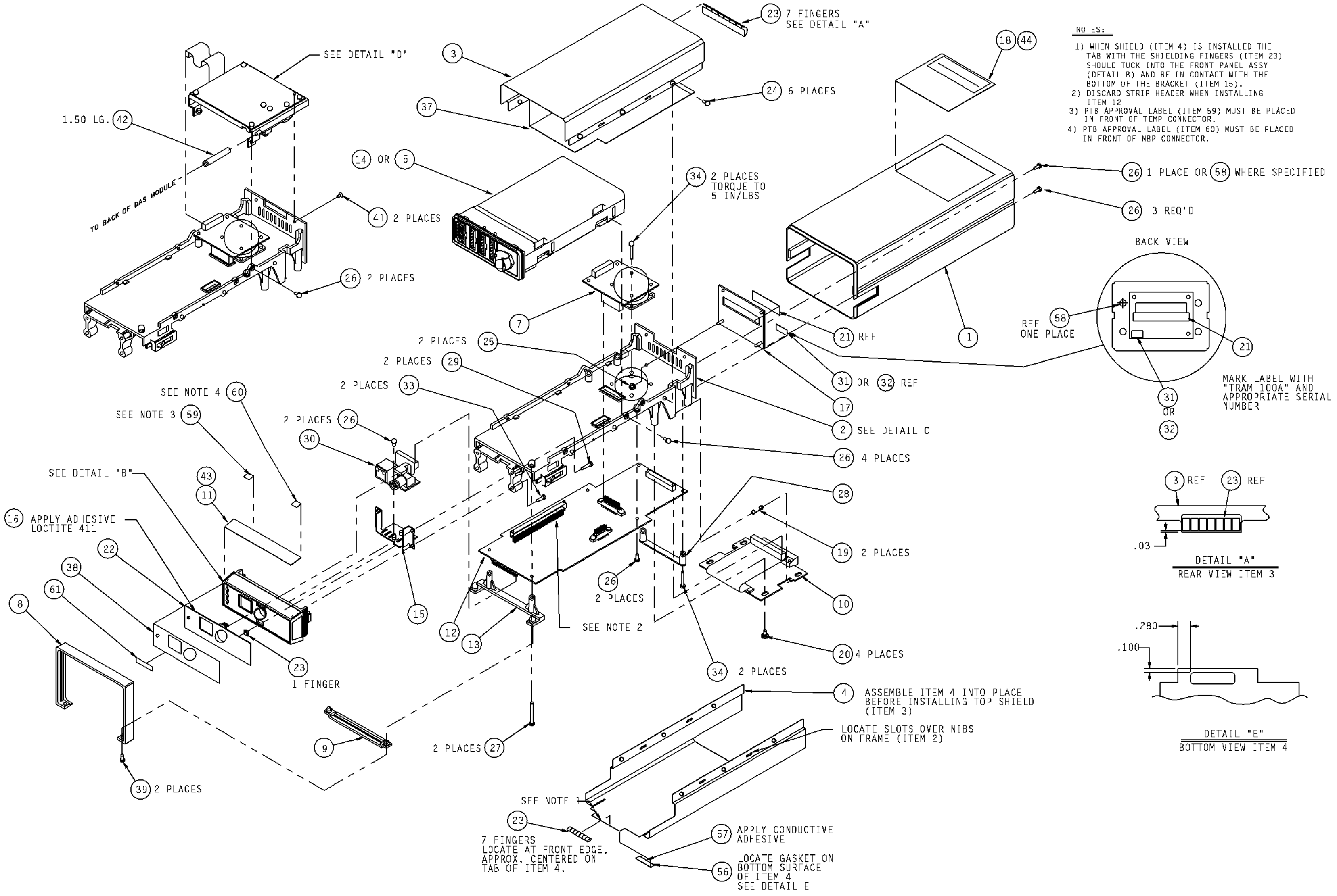
**Table 7-2. Configurations**

| Part Number | Revision | Power *f* (Hz) | ECG Leadwires | Labels | Units of Measure |
|---|---|---|---|---|---|
| 408000-001 | B | 60 | 5 | English | English |
| 408000-002 | A | 50 | 5 | English | English |
| 408000-003 | B | 60 | 5 | English | English |
| 408000-004 | A | 50 | 5 | English | English |
| 408000-005 | A | 60 | 5 | English | SI |
| 408000-006 | A | 50 | 5 | English | SI |
| 408000-007 | A | 60 | 5 | English | SI |
| 408000-008 | A | 50 | 5 | English | SI |
| 408000-011 | A | 60 | 5 | Icon | English |
| 408000-012 | A | 50 | 5 | Icon | English |
| 408000-013 | A | 60 | 5 | Icon | English |
| 408000-014 | A | 50 | 5 | Icon | English |
| 408000-015 | A | 60 | 5 | Icon | SI |
| 408000-016 | B | 50 | 5 | Icon | SI |
| 408000-017 | A | 60 | 5 | Icon | SI |
| 408000-018 | B | 50 | 5 | Icon | SI |

Part number 408000A without a dashed suffix (ie, pn 408000A, as opposed to pn 408000-001A or pn 408000-002A) refers to all of the assemblies listed in the table above. Unless otherwise noted, all assemblies are the same.

# Exploded View PN 408000C

1 of 2

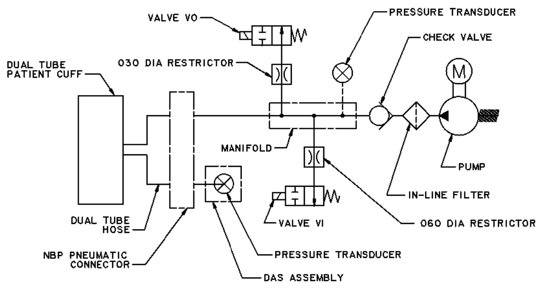


NOTES:

1) WHEN SHIELD (ITEM 4) IS INSTALLED THE TAB WITH THE SHIELDING FINGERS (ITEM 23) SHOULD TUCK INTO THE FRONT PANEL ASSY (DETAIL B) AND BE IN CONTACT WITH THE BOTTOM OF THE BRACKET (ITEM 15).
2) DISCARD STRIP HEADER WHEN INSTALLING ITEM 12
3) PTB APPROVAL LABEL (ITEM 59) MUST BE PLACED IN FRONT OF TEMP CONNECTOR.
4) PTB APPROVAL LABEL (ITEM 60) MUST BE PLACED IN FRONT OF NBP CONNECTOR.

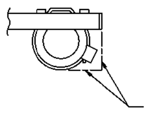
SEE DETAIL "D"
1.50 LG. (42)
TO BACK OF DAS MODULE
(3)
(37)
(23) 7 FINGERS SEE DETAIL "A"
(24) 6 PLACES
(18) (44)
(14) OR (5)
(41) 2 PLACES
(26) 2 PLACES
(34) 2 PLACES TORQUE TO 5 IN/LBS
(26) 1 PLACE OR (58) WHERE SPECIFIED
(26) 3 REQ'D
BACK VIEW
REF ONE PLACE (58)
(21)
(7)
(1)
2 PLACES (25)
2 PLACES (29)
2 PLACES (33)
(21) REF
(31) OR (32) REF
(17)
(2) SEE DETAIL C
MARK LABEL WITH "TRAM 100A" AND APPROPRIATE SERIAL NUMBER
(31) OR (32)
SEE NOTE 4 (60)
SEE NOTE 3 (59)
2 PLACES (26)
(30)
(26) 4 PLACES
(28)
(3) REF (23) REF
.03
DETAIL "A" REAR VIEW ITEM 3
SEE DETAIL "B"
(43)
(11)
(16) APPLY ADHESIVE LOCTITE 411
(22)
(38)
(61)
(8)
(15)
(12)
(13)
(26) 2 PLACES
SEE NOTE 2
(19) 2 PLACES
(10)
(20) 4 PLACES
(34) 2 PLACES
.280
.100
DETAIL "E" BOTTOM VIEW ITEM 4
(23) 1 FINGER
(9)
2 PLACES (27)
(39) 2 PLACES
(4) ASSEMBLE ITEM 4 INTO PLACE BEFORE INSTALLING TOP SHIELD (ITEM 3)
LOCATE SLOTS OVER NIBS ON FRAME (ITEM 2)
SEE NOTE 1
(23) 7 FINGERS LOCATE AT FRONT EDGE, APPROX. CENTERED ON TAB OF ITEM 4.
(57) APPLY CONDUCTIVE ADHESIVE
(56) LOCATE GASKET ON BOTTOM SURFACE OF ITEM 4 SEE DETAIL E

2 of 2


VALVE VO
PRESSURE TRANSDUCER
CHECK VALVE
DUAL TUBE PATIENT CUFF
030 DIA RESTRICTOR
M
MANIFOLD
PUMP
IN-LINE FILTER
DUAL TUBE HOSE
VALVE VI
060 DIA RESTRICTOR
NBP PNEUMATIC CONNECTOR
PRESSURE TRANSDUCER
DAS ASSEMBLY

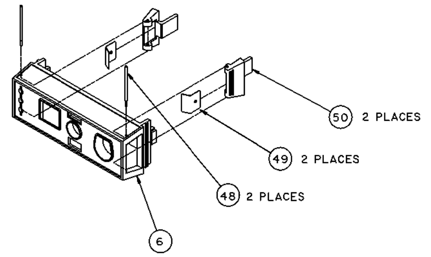
PNEUMATIC SCHEMATIC

ASSEMBLED DETAIL

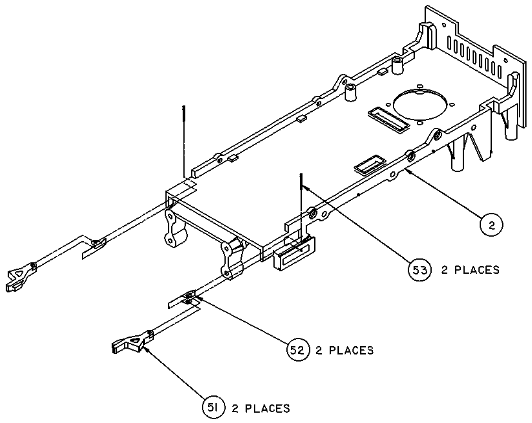


NOTE HEAD OF TIE WRAP ITEM 64 MUST NOT BREAK EITHER OF THESE PLANES AFTER ASSEMBLY

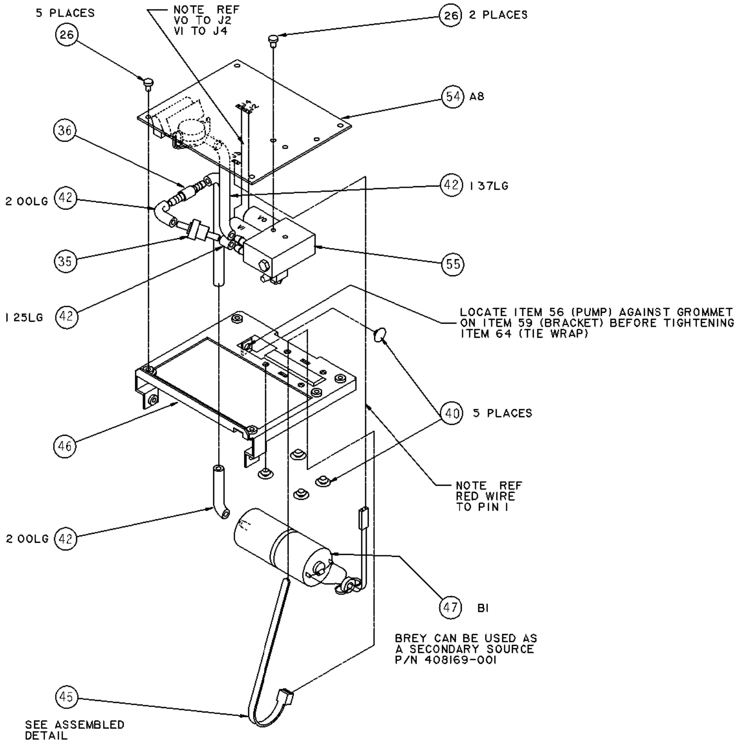
| LEAD IDENT | ITEM NO | FROM | TO |
|---|---|---|---|
| W6 | 56 | B1P3 | A8J3 |
| W4 | 57 | W5P1 | A8J2 |
| W5 | 57 | W4P1 | A8J4 |
| | | | |
| | | | |


50 2 PLACES
49 2 PLACES
48 2 PLACES
6

DETAIL C


2
53 2 PLACES
52 2 PLACES
51 2 PLACES

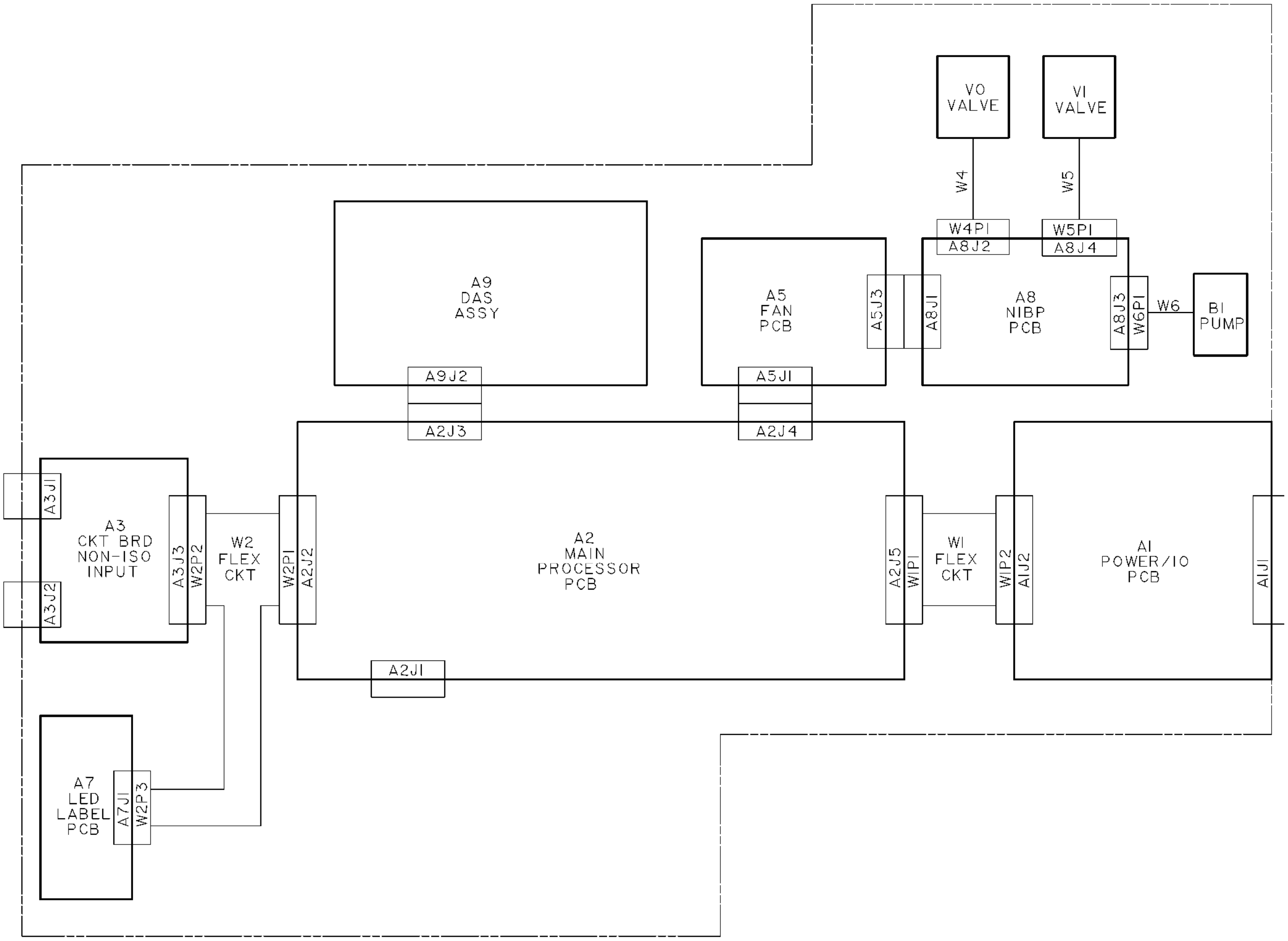
DETAIL B

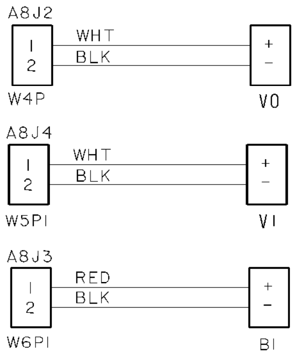

5 PLACES
26
NOTE REF
VO TO J2
VI TO J4
26 2 PLACES
54 A8
36
2 00LG 42
42 1 37LG
35
55
1 25LG 42
LOCATE ITEM 56 (PUMP) AGAINST GROMMET ON ITEM 59 (BRACKET) BEFORE TIGHTENING ITEM 64 (TIE WRAP)
40 5 PLACES
46
NOTE REF RED WIRE TO PIN 1
2 00LG 42
47 B1
BREY CAN BE USED AS A SECONDARY SOURCE P/N 408169-001
45
SEE ASSEMBLED DETAIL

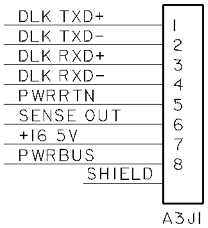
DETAIL D

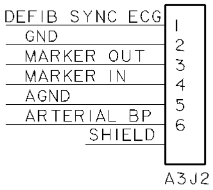
# Schematic Diagram PN 408000C

1 of 2

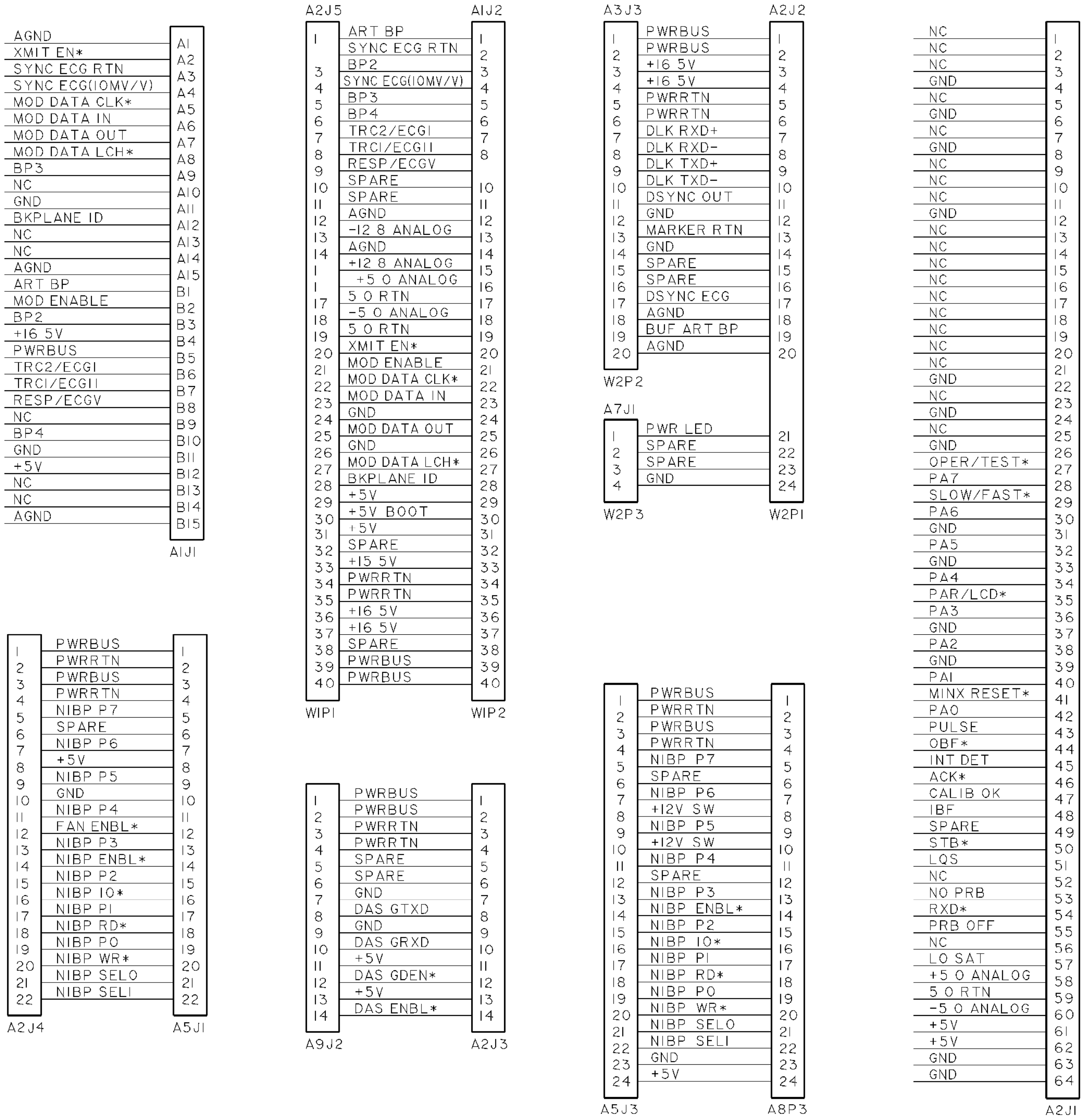

V0 VALVE
VI VALVE
W4
W5
W4PI
A8J2
W5PI
A8J4
A9 DAS ASSY
A5 FAN PCB
A5J3
A8JI
A8 NIBP PCB
A8J3
W6PI
W6
BI PUMP
A9J2
A2J3
A5JI
A2J4
A3JI
A3J2
A3 CKT BRD NON-ISO INPUT
A3J3
W2P2
W2 FLEX CKT
W2PI
A2J2
A2 MAIN PROCESSOR PCB
A2J5
WIPI
WI FLEX CKT
WIP2
AIJ2
AI POWER/IO PCB
AIJI
A2JI
A7 LED LABEL PCB
A7JI
W2P3


A8J2
1
2
WHT
BLK
W4P
+
−
V0
A8J4
1
2
WHT
BLK
W5PI
+
−
VI
A8J3
1
2
RED
BLK
W6PI
+
−
BI


DLK TXD+
DLK TXD−
DLK RXD+
DLK RXD−
PWRRTN
SENSE OUT
+16 5V
PWRBUS
SHIELD
1
2
3
4
5
6
7
8
A3JI


DEFIB SYNC ECG
GND
MARKER OUT
MARKER IN
AGND
ARTERIAL BP
SHIELD
1
2
3
4
5
6
A3J2

**2 of 2**


A1J1
AGND A1
XMIT EN* A2
SYNC ECG RTN A3
SYNC ECG(10MV/V) A4
MOD DATA CLK* A5
MOD DATA IN A6
MOD DATA OUT A7
MOD DATA LCH* A8
BP3 A9
NC A10
GND A11
BKPLANE ID A12
NC A13
NC A14
AGND A15
ART BP B1
MOD ENABLE B2
BP2 B3
+16 5V B4
PWRBUS B5
TRC2/ECGI B6
TRC1/ECGII B7
RESP/ECGV B8
NC B9
BP4 B10
GND B11
+5V B12
NC B13
NC B14
AGND B15
A2J5
A1J2
1 ART BP 1
SYNC ECG RTN 2
3 BP2 3
4 SYNC ECG(10MV/V) 4
5 BP3 5
6 BP4 6
7 TRC2/ECGI 7
8 TRC1/ECGII 8
9 RESP/ECGV
10 SPARE 10
11 SPARE 11
12 AGND 12
13 -12 8 ANALOG 13
14 AGND 14
1 +12 8 ANALOG 15
1 +5 0 ANALOG 16
17 5 0 RTN 17
18 -5 0 ANALOG 18
19 5 0 RTN 19
20 XMIT EN* 20
21 MOD ENABLE 21
22 MOD DATA CLK* 22
23 MOD DATA IN 23
24 GND 24
25 MOD DATA OUT 25
26 GND 26
27 MOD DATA LCH* 27
28 BKPLANE ID 28
29 +5V 29
30 +5V BOOT 30
31 +5V 31
32 SPARE 32
33 +15 5V 33
34 PWRRTN 34
35 PWRRTN 35
36 +16 5V 36
37 +16 5V 37
38 SPARE 38
39 PWRBUS 39
40 PWRBUS 40
W1P1
W1P2
A3J3
A2J2
1 PWRBUS 1
2 PWRBUS 2
3 +16 5V 3
4 +16 5V 4
5 PWRRTN 5
6 PWRRTN 6
7 DLK RXD+ 7
8 DLK RXD- 8
9 DLK TXD+ 9
10 DLK TXD- 10
11 DSYNC OUT 11
12 GND 12
13 MARKER RTN 13
14 GND 14
15 SPARE 15
16 SPARE 16
17 DSYNC ECG 17
18 AGND 18
19 BUF ART BP 19
20 AGND 20
W2P2
A7J1
1 PWR LED 21
2 SPARE 22
3 SPARE 23
4 GND 24
W2P3
W2P1
NC 1
NC 2
NC 3
GND 4
NC 5
GND 6
NC 7
GND 8
NC 9
NC 10
NC 11
GND 12
NC 13
NC 14
NC 15
NC 16
NC 17
NC 18
NC 19
NC 20
NC 21
GND 22
NC 23
GND 24
NC 25
GND 26
OPER/TEST* 27
PA7 28
SLOW/FAST* 29
PA6 30
GND 31
PA5 32
GND 33
PA4 34
PAR/LCD* 35
PA3 36
GND 37
PA2 38
GND 39
PA1 40
MINX RESET* 41
PA0 42
PULSE 43
OBF* 44
INT DET 45
ACK* 46
CALIB OK 47
IBF 48
SPARE 49
STB* 50
LQS 51
NC 52
NO PRB 53
RXD* 54
PRB OFF 55
NC 56
LO SAT 57
+5 0 ANALOG 58
5 0 RTN 59
-5 0 ANALOG 60
+5V 61
+5V 62
GND 63
GND 64
A2J1
1 PWRBUS 1
2 PWRRTN 2
3 PWRBUS 3
4 PWRRTN 4
5 NIBP P7 5
6 SPARE 6
7 NIBP P6 7
8 +5V 8
9 NIBP P5 9
10 GND 10
11 NIBP P4 11
12 FAN ENBL* 12
13 NIBP P3 13
14 NIBP ENBL* 14
15 NIBP P2 15
16 NIBP IO* 16
17 NIBP P1 17
18 NIBP RD* 18
19 NIBP P0 19
20 NIBP WR* 20
21 NIBP SEL0 21
22 NIBP SEL1 22
A2J4
A5J1
1 PWRBUS 1
2 PWRBUS 2
3 PWRRTN 3
4 PWRRTN 4
5 SPARE 5
6 SPARE 6
7 GND 7
8 DAS GTXD 8
9 GND 9
10 DAS GRXD 10
11 +5V 11
12 DAS GDEN* 12
13 +5V 13
14 DAS ENBL* 14
A9J2
A2J3
1 PWRBUS 1
2 PWRRTN 2
3 PWRBUS 3
4 PWRRTN 4
5 NIBP P7 5
6 SPARE 6
7 NIBP P6 7
8 +12V SW 8
9 NIBP P5 9
10 +12V SW 10
11 NIBP P4 11
12 SPARE 12
13 NIBP P3 13
14 NIBP ENBL* 14
15 NIBP P2 15
16 NIBP IO* 16
17 NIBP P1 17
18 NIBP RD* 18
19 NIBP P0 19
20 NIBP WR* 20
21 NIBP SEL0 21
22 NIBP SEL1 22
23 GND 23
24 +5V 24
A5J3
A8P3

# Parts List PN 408000C

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| | | Cover, Module | 400895-001 | 1 |
| 2 | | Frame | 400982-001 | 1 |
| 3 | | Shield, Top | 401679-001 | 1 |
| 4 | | Shield, Bottom | 401679-002 | 1 |
| 5 | A9 | 100/200 Acquisition Module, 5-Lead | 408134-001 | * |
| 6 | | Front Bezel, Lower | 401105-005 | 1 |
| 7 | A5 | Fan PCB Assembly | 403549-002 | 1 |
| 8 | | Trim, Rubber, Front Bezel | 404620-001 | 1 |
| 9 | | Mounting Strap, Trim | 404621-001 | 1 |
| 10 | A1, W1 | Power Supply PCB Assembly | 401309-002 | 1 |
| 11 | | Label, Isolated Connector Function, Tram100A/200A, English | 402313-001 | * |
| 12 | A2 | Module Processor PCB Assembly | 800210-001 | 1 |
| 13 | | Circuit Board/Bezel Mount | 404762-001 | 1 |
| 14 | A9 | Tram 100/200 Data Acquisition Module, 10-Lead | 408134-002 | * |
| 15 | | Plate, Chassis Ground, Bottom/Front | 402317-001 | 1 |
| 16 | | Adhesive, Loctite Prism 411 | 4851-082 | AR |
| 17 | | Plate, Chassis Ground, Rear | 404680-002 | 1 |
| 18 | | Label, Cover, English | 403439-001 | * |
| 19 | | Spring, Compression | 402315-001 | 2 |
| 20 | | Screw, Power Supply PCB Mounting, SST, 4-40 | 402214-001 | 4 |
| 21 | | Label, Model/Serial Number | 404525-006 | 1 |
| 22 | A7 | Power Indicator PCB Assembly | 403170-009 | 1 |
| 23 | | Spring, Chassis Ground, Rear | 403741-001 | AR |
| 24 | | Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16 | 4505-406 | 6 |
| 25 | | Nut, Hex, 4-40 | 4521-304 | 2 |
| 26 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 45074-406 | 21 |
| 27 | | Screw, BDGH, Phillips, 4-40 x 1-1/8 | 45074-436 | 2 |
| 28 | | Bracket, Power Supply PCB | 406254-001 | 1 |
| 29 | | Screw, 4-40 x 7/8 | 404069-001 | 2 |
| 30 | A3, W2 | Non-Isolated Input PCB Assembly | 401315-002 | 1 |
| 31 | | Label, 60-Hz | 70386-001 | * |
| 32 | | Label, 50-Hz | 70386-002 | * |
| 33 | | Screw, BDGH, Phillips, 4-40 x 5/8 | 45074-420 | 2 |
| 34 | | Screw, BDGH, Phillips, 4-40 x 3/4 | 45074-424 | 4 |
| 35 | | Check Valve, 0.125 ID | 404675-001 | 1 |
| 36 | | Filter, 43 Micron | 404679-001 | 1 |
| 37 | | Insulator, Bottom Shield | 404188-001 | 1 |
| 38 | | Label, Lower Bezel | 408162-001 | 1 |
| 39 | | Screw, BDGH, Phillips, 4-40 x 3/8 | 45074-412 | 2 |
| 40 | | Grommet, 1/4 Dia, 1/8 High, 1/16 Panel Thickness | 404749-001 | 5 |

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 41 | | Screw, FLH, Phillips, SST, 4-40 x 3/8 | 4505-412 | 2 |
| 42 | | Tubing, Silastic | 401582-001 | AR |
| 43 | | Label, Isolated Connector Function, Tram 100A/ 200A, Icon | 402313-002 | * |
| 44 | | Label, Cover, Icon | 403439-002 | * |
| 45 | | Tie Wrap | 4535-002 | 1 |
| 46 | | Bracket, NBP Mounting | 404296-001 | 1 |
| 47 | B1, W6 | Pump Assembly, NBP, w/Harness | 408169-002 | 1 |
| 48 | | Pin, Latch | 402806-001 | 2 |
| 49 | | Spring, Flat, SST | 405041-001 | 2 |
| 50 | | Button, Latch | 402106-001 | 2 |
| 51 | | Latch | 401682-001 | 2 |
| 52 | | Spring, Latch | 406019-001 | 2 |
| 53 | | Pin, Latch | 406037-001 | 2 |
| 54 | A8 | NBP PCB Assembly | 800316-001 | 1 |
| 55 | V0, V1, W4, W5 | NBP Valve Assembly | 404459-001 | 1 |
| 56 | | Gasket, Silver-Nickel | 407894-001 | 1 |
| 57 | | Adhesive, Conductive | 4851-088 | AR |
| 58 | | Screw, PNHD, 4-40 x 0.188 | 409009-001 | * |
| 59 | | Label, PTB Approval | 409047-002 | * |
| 60 | | Label, PTB Approval | 409047-001 | * |
| 61 | | Label, Leadwire Warning | 414097-001 | * |

*See the following chart:

| | Assembly Configuration | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Item | -001 | -002 | -003 | -004 | -005 | -006 | -007 | -008 | -011 | -012 | -013 | -014 | -015 | -016 | -017 | -018 |
| 5 | 1 | 1 | – | – | 1 | 1 | – | – | 1 | 1 | – | – | 1 | 1 | – | – |
| 11 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | – | – | – | – | – | – | – | – |
| 14 | – | – | 1 | 1 | – | – | 1 | 1 | – | – | 1 | 1 | – | – | 1 | 1 |
| 18 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | – | – | – | – | – | – | – | – |
| 31 | 1 | – | 1 | – | 1 | – | 1 | – | 1 | – | 1 | – | 1 | – | 1 | – |
| 32 | – | 1 | – | 1 | – | 1 | – | 1 | – | 1 | – | 1 | – | 1 | – | 1 |
| 43 | – | – | – | 1 | – | – | – | – | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 44 | – | – | – | – | – | – | – | – | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 58 | – | – | – | – | – | – | – | – | – | – | – | – | – | 1 | – | 1 |
| 59 | – | – | – | – | – | – | – | – | – | – | – | – | – | 1 | – | 1 |
| 60 | – | – | – | – | – | – | – | – | – | – | – | – | – | 1 | – | 1 |
| 61 | 1 | – | 1 | – | – | – | – | – | – | – | – | – | – | – | – | – |

# Assembly Revisions PN 408000

The baseline revision for this assembly is pn 408000C. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

**PN 408000A**

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 58 | | Screw, BDGH, 4-40 x 0.188 | 45074-406 | 40900-001 | * |
| 59 | | Label, German PTB | Not Used | 409047-002 | 1 |
| 60 | | Label, German PTB | Not Used | 409047-001 | 1 |
| 61 | | Label, Leadwires Warning | Not Used | 414097-001 | 1 |

**PN 408000B**

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 61 | | Label, Leadwires Warning | Not Used | 414097-001 | 1 |

*For your notes*

# 8 TRAM 200A/SL MODULE PN 408001/411160

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# General

## Circuit Boards

Details about the circuit boards contained in the Tram 200A/SL are discussed in later chapters arranged by part number.

**Table 8-1. Circuit Board Overview**

| Module Type | Upper Level | Leadwire Configuration | DAS Module | Acquisition Processor PCB | Module Processor PCB |
|---|---|---|---|---|---|
| Tram 200A | 408001-0XXA–C | 5-Leadwire | 408134-002 | 800330-006 | 800210-005 |
| Tram 200SL | 411160-001A–G | 10-Leadwire | 411166-001 | 800330-006 | 800210-005 |
| Tram 200SL | 411160-001H | 10-Leadwire | 417120-001<br>(Replaced 411166-001) | 801040-001 | 800210-005 |

## Tram 200A Configurations

At the time of this writing, 16 configurations of the Tram 200A module are available. The differences between configurations are in the power frequency, the type of labelling, and the units of measure used. The table below lists the available configurations.

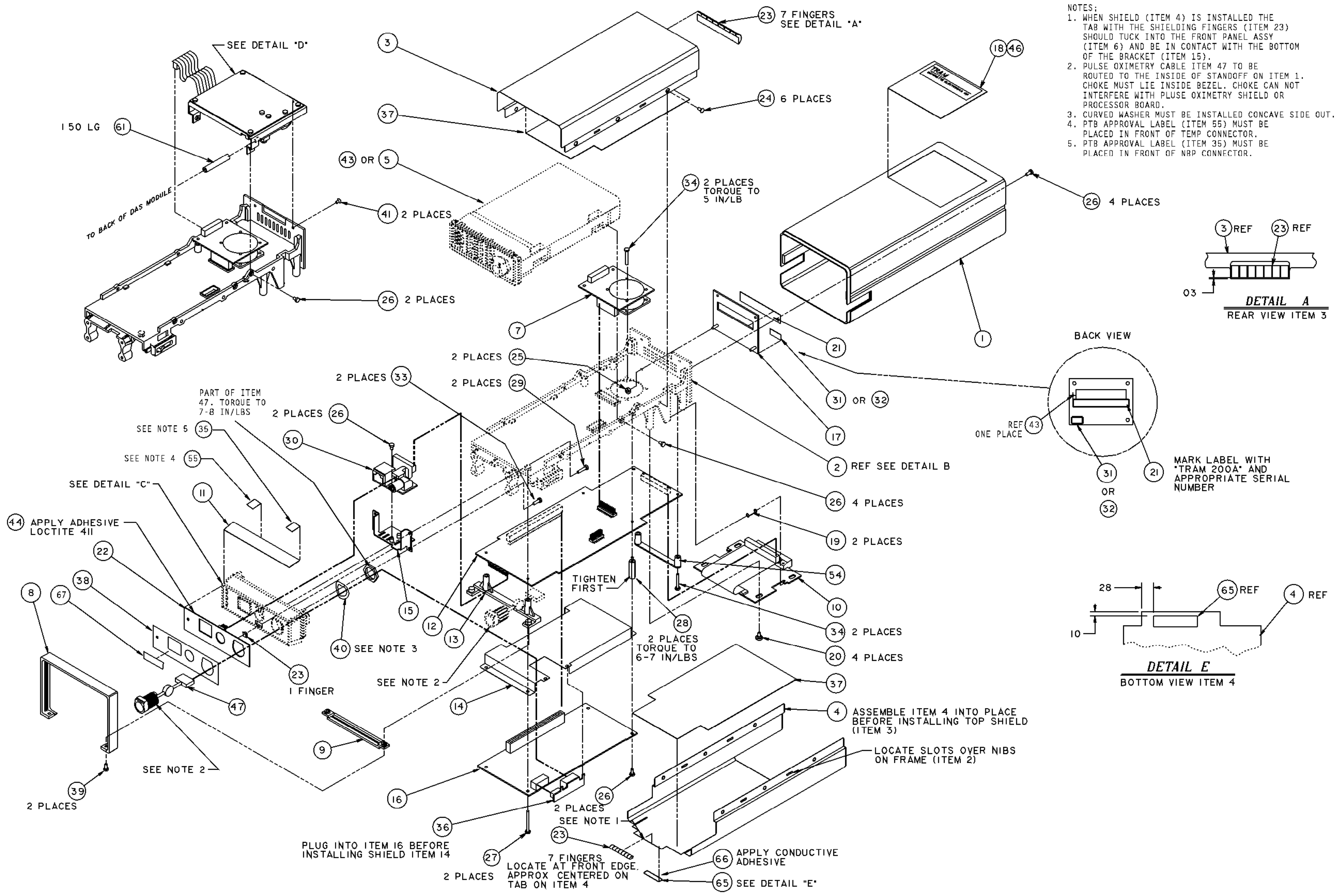
**Table 8-2. Configurations**

| Part Number | Rev | Power *f* (Hz) | Labels | Units of Measure |
|---|---|---|---|---|
| 408001-001 | B | 60 | English | English |
| 408001-002 | A | 50 | English | English |
| 408001-003 | B | 60 | English | English |
| 408001-004 | A | 50 | English | English |
| 408001-005 | A | 60 | English | SI |
| 408001-006 | A | 50 | English | SI |
| 408001-007 | A | 60 | English | SI |
| 408001-008 | A | 50 | English | SI |
| 408001-011 | A | 60 | Icon | English |
| 408001-012 | A | 50 | Icon | English |
| 408001-013 | A | 60 | Icon | English |
| 408001-014 | A | 50 | Icon | English |
| 408001-015 | A | 60 | Icon | SI |
| 408001-016 | B | 50 | Icon | SI |
| 408001-017 | A | 60 | Icon | SI |
| 408001-018 | B | 50 | Icon | SI |

Part number 408001A without a dashed suffix (ie, pn 408001A, as opposed to pn 408001-001A or pn 408000-002A) refers to all of the assemblies listed in the table above. Unless otherwise noted, all assemblies are the same.

# Exploded View PN 408001C

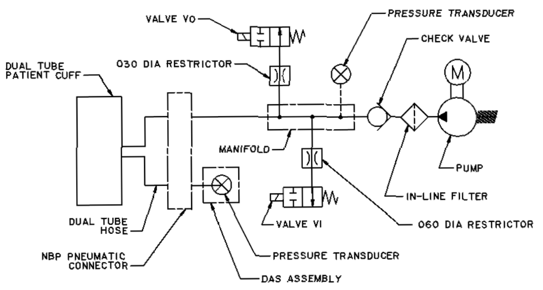
1 of 2


23 7 FINGERS SEE DETAIL "A"
18 46
24 6 PLACES
26 4 PLACES
3
37
43 OR 5
34 2 PLACES TORQUE TO 5 IN/LB
1
3 REF
23 REF
03
DETAIL A
REAR VIEW ITEM 3
BACK VIEW
REF 43 ONE PLACE
31 OR 32
21
MARK LABEL WITH "TRAM 200A" AND APPROPRIATE SERIAL NUMBER
SEE DETAIL "D"
150 LG 61
TO BACK OF DAS MODULE
41 2 PLACES
26 2 PLACES
7
21
31 OR 32
17
2 REF SEE DETAIL B
2 PLACES 25
2 PLACES 29
2 PLACES 33
PART OF ITEM 47. TORQUE TO 7-8 IN/LBS
2 PLACES 26
SEE NOTE 5 35
30
SEE NOTE 4 55
SEE DETAIL "C"
11
44 APPLY ADHESIVE LOCTITE 411
22
8
67
38
23 1 FINGER
47
40 SEE NOTE 3
15
12
13
SEE NOTE 2
14
9
39 2 PLACES
SEE NOTE 2
16
36
PLUG INTO ITEM 16 BEFORE INSTALLING SHIELD ITEM 14
27 2 PLACES
23 7 FINGERS LOCATE AT FRONT EDGE. APPROX CENTERED ON TAB ON ITEM 4
26 2 PLACES SEE NOTE 1
TIGHTEN FIRST
28 2 PLACES TORQUE TO 6-7 IN/LBS
26 4 PLACES
19 2 PLACES
54
10
34 2 PLACES
20 4 PLACES
37
4 ASSEMBLE ITEM 4 INTO PLACE BEFORE INSTALLING TOP SHIELD (ITEM 3)
LOCATE SLOTS OVER NIBS ON FRAME (ITEM 2)
66 APPLY CONDUCTIVE ADHESIVE
65 SEE DETAIL "E"
28
10
65 REF
4 REF
DETAIL E
BOTTOM VIEW ITEM 4

NOTES:
1. WHEN SHIELD (ITEM 4) IS INSTALLED THE TAB WITH THE SHIELDING FINGERS (ITEM 23) SHOULD TUCK INTO THE FRONT PANEL ASSY (ITEM 6) AND BE IN CONTACT WITH THE BOTTOM OF THE BRACKET (ITEM 15).
2. PULSE OXIMETRY CABLE ITEM 47 TO BE ROUTED TO THE INSIDE OF STANDOFF ON ITEM 1. CHOKE MUST LIE INSIDE BEZEL. CHOKE CAN NOT INTERFERE WITH PLUSE OXIMETRY SHIELD OR PROCESSOR BOARD.
3. CURVED WASHER MUST BE INSTALLED CONCAVE SIDE OUT.
4. PTB APPROVAL LABEL (ITEM 55) MUST BE PLACED IN FRONT OF TEMP CONNECTOR.
5. PTB APPROVAL LABEL (ITEM 35) MUST BE PLACED IN FRONT OF NBP CONNECTOR.

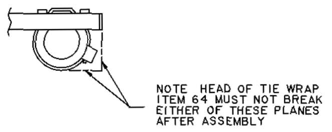
**2 of 2**

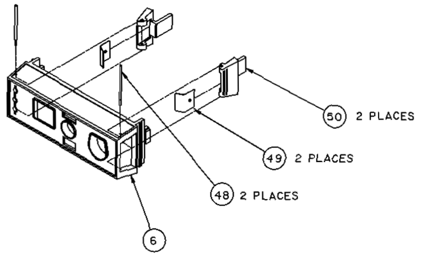
| LEAD IDENT | ITEM NO | FROM | TO |
|---|---|---|---|
| W6 | 56 | BIP3 | A8J3 |
| W4 | 57 | W4P2 | A8J2 |
| W5 | 57 | W5P4 | A8J4 |
| | | | |
| | | | |


VALVE VO
PRESSURE TRANSDUCER
CHECK VALVE
DUAL TUBE PATIENT CUFF
030 DIA RESTRICTOR
M
MANIFOLD
PUMP
IN-LINE FILTER
DUAL TUBE HOSE
VALVE VI
060 DIA RESTRICTOR
NBP PNEUMATIC CONNECTOR
PRESSURE TRANSDUCER
DAS ASSEMBLY

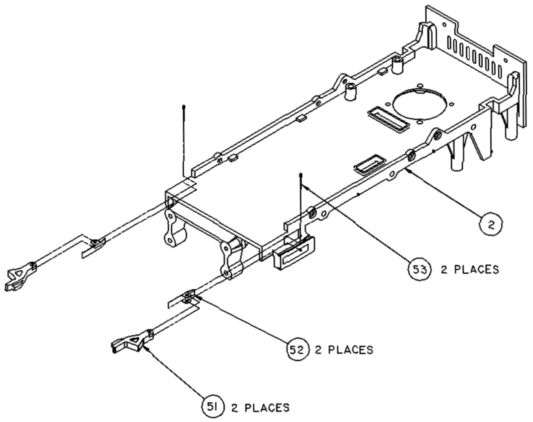
PNEUMATIC SCHEMATIC

ASSEMBLED DETAIL

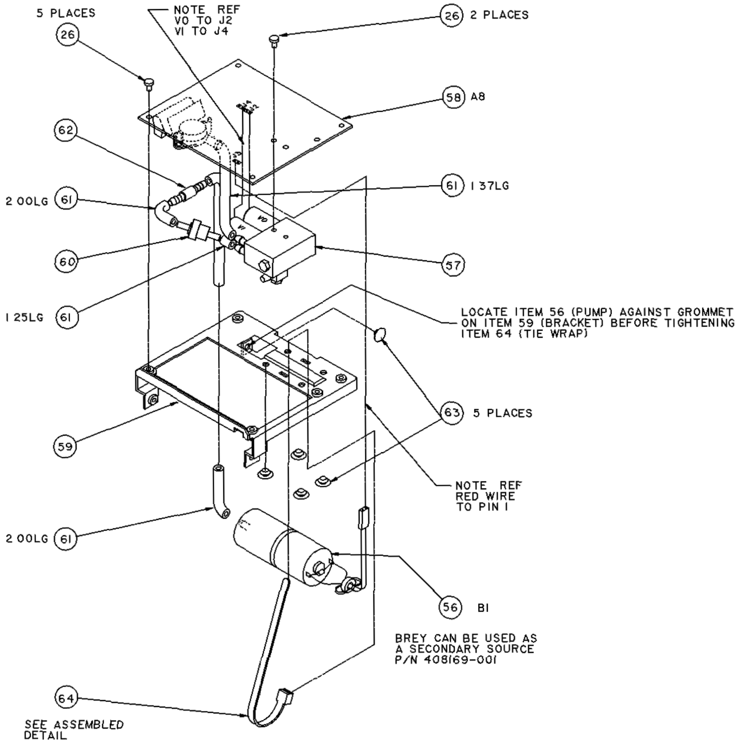

NOTE HEAD OF TIE WRAP ITEM 64 MUST NOT BREAK EITHER OF THESE PLANES AFTER ASSEMBLY


50 2 PLACES
49 2 PLACES
48 2 PLACES
6

DETAIL C


2
53 2 PLACES
52 2 PLACES
51 2 PLACES

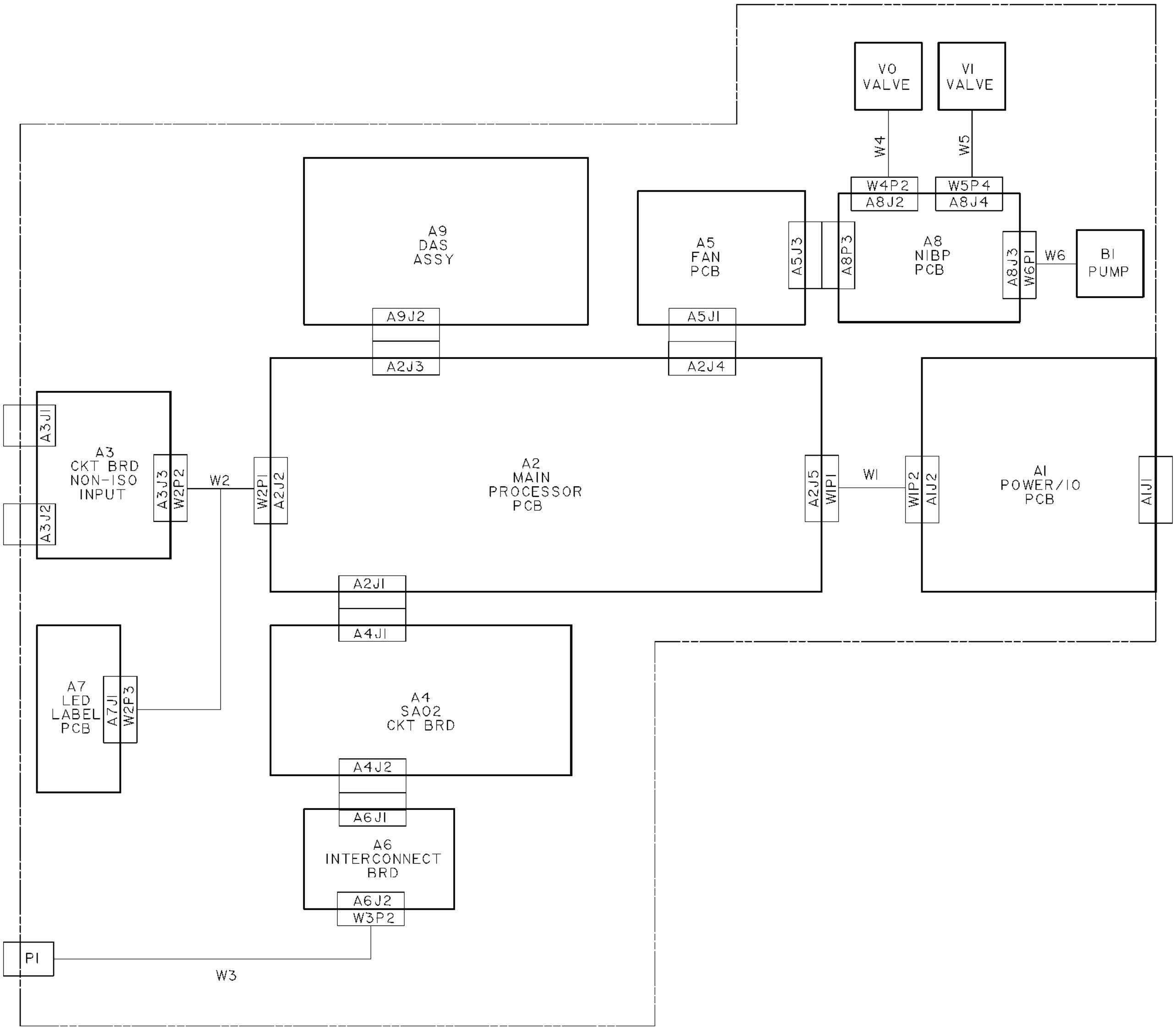
DETAIL B


5 PLACES 26
NOTE REF VO TO J2 VI TO J4
26 2 PLACES
58 A8
62
61 1 37LG
2 00LG 61
60
57
1 25LG 61
LOCATE ITEM 56 (PUMP) AGAINST GROMMET ON ITEM 59 (BRACKET) BEFORE TIGHTENING ITEM 64 (TIE WRAP)
63 5 PLACES
59
NOTE REF RED WIRE TO PIN 1
2 00LG 61
56 B1
BREY CAN BE USED AS A SECONDARY SOURCE P/N 408169-001
64
SEE ASSEMBLED DETAIL

DETAIL D

# Schematic Diagram PN 408001C

1 of 3


VO VALVE
VI VALVE
W4
W5
W4P2
W5P4
A8J2
A8J4
A9 DAS ASSY
A5 FAN PCB
A5J3
A8P3
A8 NIBP PCB
A8J3
W6P1
W6
B1 PUMP
A9J2
A5J1
A2J3
A2J4
A3J1
A3 CKT BRD NON-ISO INPUT
A3J3
W2P2
W2
W2P1
A2J2
A2 MAIN PROCESSOR PCB
A2J5
W1P1
W1
W1P2
A1J2
A1 POWER/IO PCB
A1J1
A3J2
A2J1
A4J1
A7 LED LABEL PCB
A7J1
W2P3
A4 SA02 CKT BRD
A4J2
A6J1
A6 INTERCONNECT BRD
A6J2
W3P2
P1
W3

**2 of 3**

| Signal | A1J1 |
|---|---|
| AGND | A1 |
| XMIT EN* | A2 |
| SYNC ECG RTN | A3 |
| SYNC ECG(10MV/V) | A4 |
| MOD DATA CLK* | A5 |
| MOD DATA IN | A6 |
| MOD DATA OUT | A7 |
| MOD DATA LCH* | A8 |
| BP3 | A9 |
| NC | A10 |
| GND | A11 |
| BKPLANE ID | A12 |
| NC | A13 |
| NC | A14 |
| AGND | A15 |
| ART BP | B1 |
| MOD ENABLE | B2 |
| BP2 | B3 |
| +16 5V | B4 |
| PWRBUS | B5 |
| TRC2/ECGI | B6 |
| TRC1/ECGII | B7 |
| RESP/ECGV | B8 |
| NC | B9 |
| BP4 | B10 |
| GND | B11 |
| +5V | B12 |
| NC | B13 |
| NC | B14 |
| AGND | B15 |

| A2J4 | | A5J1 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRRTN | 2 |
| 3 | PWRBUS | 3 |
| 4 | PWRRTN | 4 |
| 5 | NIBP P7 | 5 |
| 6 | SPARE | 6 |
| 7 | NIBP P6 | 7 |
| 8 | +5V | 8 |
| 9 | NIBP P5 | 9 |
| 10 | GND | 10 |
| 11 | NIBP P4 | 11 |
| 12 | FAN ENBL* | 12 |
| 13 | NIBP P3 | 13 |
| 14 | NIBP ENBL* | 14 |
| 15 | NIBP P2 | 15 |
| 16 | NIBP IO* | 16 |
| 17 | NIBP P1 | 17 |
| 18 | NIBP RD* | 18 |
| 19 | NIBP P0 | 19 |
| 20 | NIBP WR* | 20 |
| 21 | NIBP SEL0 | 21 |
| 22 | NIBP SEL1 | 22 |

| A2J5 | | A1J2 |
|---|---|---|
| 1 | ART BP | 1 |
| 2 | SYNC ECG RTN | 2 |
| 3 | BP2 | 3 |
| 4 | SYNC ECG(10MV/V) | 4 |
| 5 | BP3 | 5 |
| 6 | BP4 | 6 |
| 7 | TRC2/ECGI | 7 |
| 8 | TRC1/ECGII | 8 |
| 9 | RESP/ECGV | 9 |
| 10 | SPARE | 10 |
| 11 | SPARE | 11 |
| 12 | AGND | 12 |
| 13 | -12 8 ANALOG | 13 |
| 14 | AGND | 14 |
| 15 | +12 8 ANALOG | 15 |
| 16 | +5 0 ANALOG | 16 |
| 17 | 5 0 RTN | 17 |
| 18 | -5 0 ANALOG | 18 |
| 19 | 5 0 RTN | 19 |
| 20 | XMIT EN* | 20 |
| 21 | MOD ENABLE | 21 |
| 22 | MOD DATA CLK* | 22 |
| 23 | MOD DATA IN | 23 |
| 24 | GND | 24 |
| 25 | MOD DATA OUT | 25 |
| 26 | GND | 26 |
| 27 | MOD DATA LCH* | 27 |
| 28 | BKPLANE ID | 28 |
| 29 | +5V | 29 |
| 30 | +5V BOOT | 30 |
| 31 | +5V | 31 |
| 32 | SPARE | 32 |
| 33 | +15 5V | 33 |
| 34 | PWRRTN | 34 |
| 35 | PWRRTN | 35 |
| 36 | +16 5V | 36 |
| 37 | +16 5V | 37 |
| 38 | SPARE | 38 |
| 39 | PWRBUS | 39 |
| 40 | PWRBUS | 40 |
| W1P1 | | W1P2 |

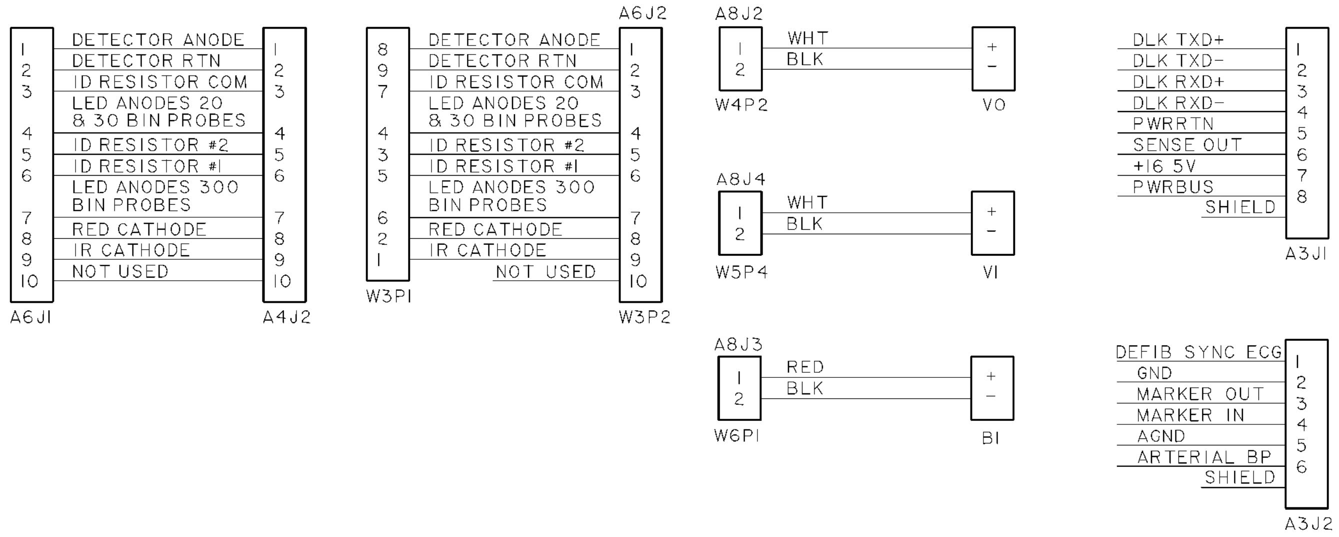
| A9J2 | | A2J3 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRBUS | 2 |
| 3 | PWRRTN | 3 |
| 4 | PWRRTN | 4 |
| 5 | SPARE | 5 |
| 6 | SPARE | 6 |
| 7 | GND | 7 |
| 8 | DAS GTXD | 8 |
| 9 | GND | 9 |
| 10 | DAS GRXD | 10 |
| 11 | +5V | 11 |
| 12 | DAS GDEN* | 12 |
| 13 | +5V | 13 |
| 14 | DAS ENBL* | 14 |

| A3J3 / A7J1 | | A2J2 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRBUS | 2 |
| 3 | +16 5V | 3 |
| 4 | +16 5V | 4 |
| 5 | PWRRTN | 5 |
| 6 | PWRRTN | 6 |
| 7 | DLK RXD+ | 7 |
| 8 | DLK RXD- | 8 |
| 9 | DLK TXD+ | 9 |
| 10 | DLK TXD- | 10 |
| 11 | DSYNC OUT | 11 |
| 12 | GND | 12 |
| 13 | MARKER RTN | 13 |
| 14 | GND | 14 |
| 15 | SPARE | 15 |
| 16 | SPARE | 16 |
| 17 | DSYNC ECG | 17 |
| 18 | AGND | 18 |
| 19 | BUF ART BP | 19 |
| 20 | AGND | 20 |
| W2P2 | | |
| A7J1 | | |
| 1 | PWR LED | 21 |
| 2 | SPARE | 22 |
| 3 | SPARE | 23 |
| 4 | GND | 24 |
| W2P3 | | W2P1 |

| A5J3 | | A8P3 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRRTN | 2 |
| 3 | PWRBUS | 3 |
| 4 | PWRRTN | 4 |
| 5 | NIBP P7 | 5 |
| 6 | SPARE | 6 |
| 7 | NIBP P6 | 7 |
| 8 | +12V SW | 8 |
| 9 | NIBP P5 | 9 |
| 10 | +12V SW | 10 |
| 11 | NIBP P4 | 11 |
| 12 | SPARE | 12 |
| 13 | NIBP P3 | 13 |
| 14 | NIBP ENBL* | 14 |
| 15 | NIBP P2 | 15 |
| 16 | NIBP IO* | 16 |
| 17 | NIBP P1 | 17 |
| 18 | NIBP RD* | 18 |
| 19 | NIBP P0 | 19 |
| 20 | NIBP WR* | 20 |
| 21 | NIBP SEL0 | 21 |
| 22 | NIBP SEL1 | 22 |
| 23 | GND | 23 |
| 24 | +5V | 24 |

| A4J1 | | A2J1 |
|---|---|---|
| 1 | NC | 1 |
| 2 | NC | 2 |
| 3 | NC | 3 |
| 4 | GND | 4 |
| 5 | NC | 5 |
| 6 | GND | 6 |
| 7 | NC | 7 |
| 8 | GND | 8 |
| 9 | NC | 9 |
| 10 | NC | 10 |
| 11 | NC | 11 |
| 12 | GND | 12 |
| 13 | NC | 13 |
| 14 | NC | 14 |
| 15 | NC | 15 |
| 16 | NC | 16 |
| 17 | NC | 17 |
| 18 | NC | 18 |
| 19 | NC | 19 |
| 20 | NC | 20 |
| 21 | NC | 21 |
| 22 | GND | 22 |
| 23 | NC | 23 |
| 24 | GND | 24 |
| 25 | NC | 25 |
| 26 | GND | 26 |
| 27 | OPER/TEST* | 27 |
| 28 | PA7 | 28 |
| 29 | SLOW/FAST* | 29 |
| 30 | PA6 | 30 |
| 31 | GND | 31 |
| 32 | PA5 | 32 |
| 33 | GND | 33 |
| 34 | PA4 | 34 |
| 35 | PAR/LCD* | 35 |
| 36 | PA3 | 36 |
| 37 | GND | 37 |
| 38 | PA2 | 38 |
| 39 | GND | 39 |
| 40 | PA1 | 40 |
| 41 | MINX RESET* | 41 |
| 42 | PA0 | 42 |
| 43 | PULSE | 43 |
| 44 | OBF* | 44 |
| 45 | INT DET | 45 |
| 46 | ACK* | 46 |
| 47 | CALIB OK | 47 |
| 48 | IBF | 48 |
| 49 | SPARE | 49 |
| 50 | STB* | 50 |
| 51 | LQS | 51 |
| 52 | NC | 52 |
| 53 | NO PRB | 53 |
| 54 | RXD* | 54 |
| 55 | PRB OFF | 55 |
| 56 | NC | 56 |
| 57 | LO SAT | 57 |
| 58 | +5 0 ANALOG | 58 |
| 59 | 5 0 RTN | 59 |
| 60 | -5 0 ANALOG | 60 |
| 61 | +5V | 61 |
| 62 | +5V | 62 |
| 63 | GND | 63 |
| 64 | GND | 64 |

3 of 3


A6J1
1
2
3
4
5
6
7
8
9
10
DETECTOR ANODE
DETECTOR RTN
ID RESISTOR COM
LED ANODES 20
& 30 BIN PROBES
ID RESISTOR #2
ID RESISTOR #1
LED ANODES 300
BIN PROBES
RED CATHODE
IR CATHODE
NOT USED
A4J2
1
2
3
4
5
6
7
8
9
10
W3P1
8
9
7
4
3
5
6
2
1
DETECTOR ANODE
DETECTOR RTN
ID RESISTOR COM
LED ANODES 20
& 30 BIN PROBES
ID RESISTOR #2
ID RESISTOR #1
LED ANODES 300
BIN PROBES
RED CATHODE
IR CATHODE
NOT USED
A6J2
W3P2
1
2
3
4
5
6
7
8
9
10
A8J2
1
2
WHT
BLK
+
−
W4P2
V0
A8J4
1
2
WHT
BLK
+
−
W5P4
V1
A8J3
1
2
RED
BLK
+
−
W6P1
B1
DLK TXD+
DLK TXD−
DLK RXD+
DLK RXD−
PWRRTN
SENSE OUT
+16.5V
PWRBUS
SHIELD
1
2
3
4
5
6
7
8
A3J1
DEFIB SYNC ECG
GND
MARKER OUT
MARKER IN
AGND
ARTERIAL BP
SHIELD
1
2
3
4
5
6
A3J2

# Parts List PN 408001C

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 1 | | Cover, Module | 400895-001 | 1 |
| 2 | | Frame | 400982-001 | 1 |
| 3 | | Shield, Top | 401679-001 | 1 |
| 4 | | Shield, Bottom | 401679-002 | 1 |
| 5 | A9 | 100/200 Acquisition Module, 5-Lead | 408134-001 | * |
| 6 | | Front Bezel, Lower | 401105-004 | 1 |
| 7 | A5 | Fan PCB | 403549-002 | 1 |
| 8 | | Trim, Rubber, Front Bezel | 404620-001 | 1 |
| 9 | | Mounting Strap, Trim | 404621-001 | 1 |
| 10 | A1 | Power Supply PCB | 401309-002 | 1 |
| 11 | | Label, Isolated Connector Function, Tram 100A/ 200A, English | 402313-001 | * |
| 12 | A2 | Module Processor PCB | 800210-001 | 1 |
| 13 | | Circuit Board/Bezel Mount | 404672-001 | 1 |
| 14 | | Shield, Pulse Oximetry PCB | 401680-001 | 1 |
| 15 | | Plate, Chassis Ground, Bottom/Front | 402317-001 | 1 |
| 16 | A4 | Pulse Oximetry PCB | 401189-001 | 1 |
| 17 | | Plate, Chassis Ground, Rear | 404680-002 | 1 |
| 18 | | Label, Cover, English | 403439-001 | * |
| 19 | | Spring, Compression | 402315-001 | 2 |
| 20 | | Screw, Power Supply PCB Mounting, SST, 4-40 | 402214-001 | 4 |
| 21 | | Label, Model/Serial Number | 404525-006 | 1 |
| 22 | A7 | Power Indicator PCB | 403170-008 | 1 |
| 23 | | Spring, Chassis Ground, Rear | 403741-001 | AR |
| 24 | | Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16 | 4505-406 | 6 |
| 25 | | Nut, Hex, 4-40 | 4521-304 | 2 |
| 26 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 45074-406 | 19 |
| 27 | | Screw, BDGH, Phillips, 4-40 x 1-3/8 | 45074-438 | 2 |
| 28 | | Spacer, Male/Female, 4-40 x 0.875 | 4656-414 | 2 |
| 29 | | Screw, 4-40 x 7/8 | 404069-001 | 2 |
| 30 | A3, W2 | Non-Isolated Input PCB | 401315-002 | 1 |
| 31 | | Label, 60-Hz | 70386-001 | * |
| 32 | | Label, 50-Hz | 70386-002 | * |
| 33 | | Screw, BDGH, Phillips, 4-40 x 5/8 | 45074-420 | 2 |
| 34 | | Screw, BDGH, Phillips, 4-40 x 3/4 | 45074-424 | 4 |
| 35 | | Label, PTB Approval | 409047-001 | * |
| 36 | A6 | Interconnect PCB | 800006-001 | 1 |
| 37 | | Insulator, Bottom Shield | 404188-001 | 2 |
| 38 | | Label, Lower Bezel | 408162-002 | 1 |
| 39 | | Screw, BDGH, Phillips, 4-40 x 3/8 | 45074-412 | 2 |
| 40 | | Washer, Pulse Oximetry Connector | 4550-250 | 1 |

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 41 | | Screw, FLH, Phillips, SST, 4-40 x 3/8 | 4505-412 | 2 |
| 42 | | Screw, PNHD, 4-40 x 0.188 | 409009-001 | * |
| 43 | A9 | Tram 100/200 Data Acquisition Module, 10-Lead | 408134-002 | * |
| 44 | | Adhesive, Loctite Prism 411 | 4851-082 | AR |
| 45 | | Label, Isolated Connector Function, Tram 100A/ 200A, English | 402313-001 | * |
| 46 | | Label, Cover, Icon | 403439-002 | * |
| 47 | W3 | Harness, Pulse Oximetry PCB-to-Connector | 700091-001 | 1 |
| 48 | | Pin, Latch | 402806-001 | 2 |
| 49 | | Spring, Flat, SST | 405041-001 | 2 |
| 50 | | Button, Latch | 402106-001 | 2 |
| 51 | | Latch | 401682-001 | 2 |
| 52 | | Spring, Latch | 406019-001 | 2 |
| 53 | | Pin, Latch | 406037-001 | 2 |
| 54 | | Bracket, Power Supply PCB | 406254-001 | 1 |
| 55 | | Label, PTB Approval | 409047-002 | * |
| 56 | B1, W6 | Pump Assembly, NBP, w/Harness | 408169-002 | 1 |
| 57 | V0, V1, W4, W5 | NBP Valve Assembly | 404459-001 | 1 |
| 58 | A8 | NBP PCB | 800316-001 | 1 |
| 59 | | Bracket, NBP Mounting | 404296-001 | 1 |
| 60 | | Check Valve, 0.125 ID | 404675-001 | 1 |
| 61 | | Tubing, Silastic | 401582-001 | AR |
| 62 | | Filter, 43 Micron | 404679-001 | 1 |
| 63 | | Grommet, 1/4 Dia, 1/8 High, 1/16 Panel | | |
| | | Thickness | 404749-001 | 5 |
| 64 | | Tie Wrap | 4535-002 | 1 |
| 65 | | Gasket, Silver-Nickel | 407894-001 | 1 |
| 66 | | Adhesive, Conductive | 4851-088 | AR |
| 67 | | Label, Leadwire Warning | 414097-001 | * |

*See the following chart:

| Item | Assembly Configuration | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | -001 | -002 | -003 | -004 | -005 | -006 | -007 | -008 | -011 | -012 | -013 | -014 | -015 | -016 | -017 | -018 |
| 5 | 1 | 1 | – | – | 1 | 1 | – | – | 1 | 1 | – | – | 1 | 1 | – | – |
| 11 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | – | – | – | – | – | – | – | – |
| 18 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | – | – | – | – | – | – | – | – |
| 31 | 1 | – | 1 | – | 1 | – | 1 | – | 1 | – | 1 | – | 1 | – | 1 | – |
| 32 | – | 1 | – | 1 | – | 1 | – | 1 | – | 1 | – | 1 | – | 1 | – | 1 |
| 35 | – | – | – | – | – | – | – | – | – | – | – | – | – | 1 | – | 1 |
| 42 | – | – | – | – | – | – | – | – | – | – | – | – | – | 1 | – | 1 |
| 43 | – | – | 1 | 1 | – | – | 1 | 1 | – | – | 1 | 1 | – | – | 1 | 1 |
| 45 | – | – | – | – | – | – | – | – | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 46 | – | – | – | – | – | – | – | – | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 55 | – | – | – | – | – | – | – | – | – | – | – | – | – | 1 | – | 1 |
| 67 | 1 | – | 1 | – | – | – | – | – | – | – | – | – | – | – | – | – |

# Assembly Revisions PN 408001

The baseline revision for this assembly is pn 408001C. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

**PN 408001A**

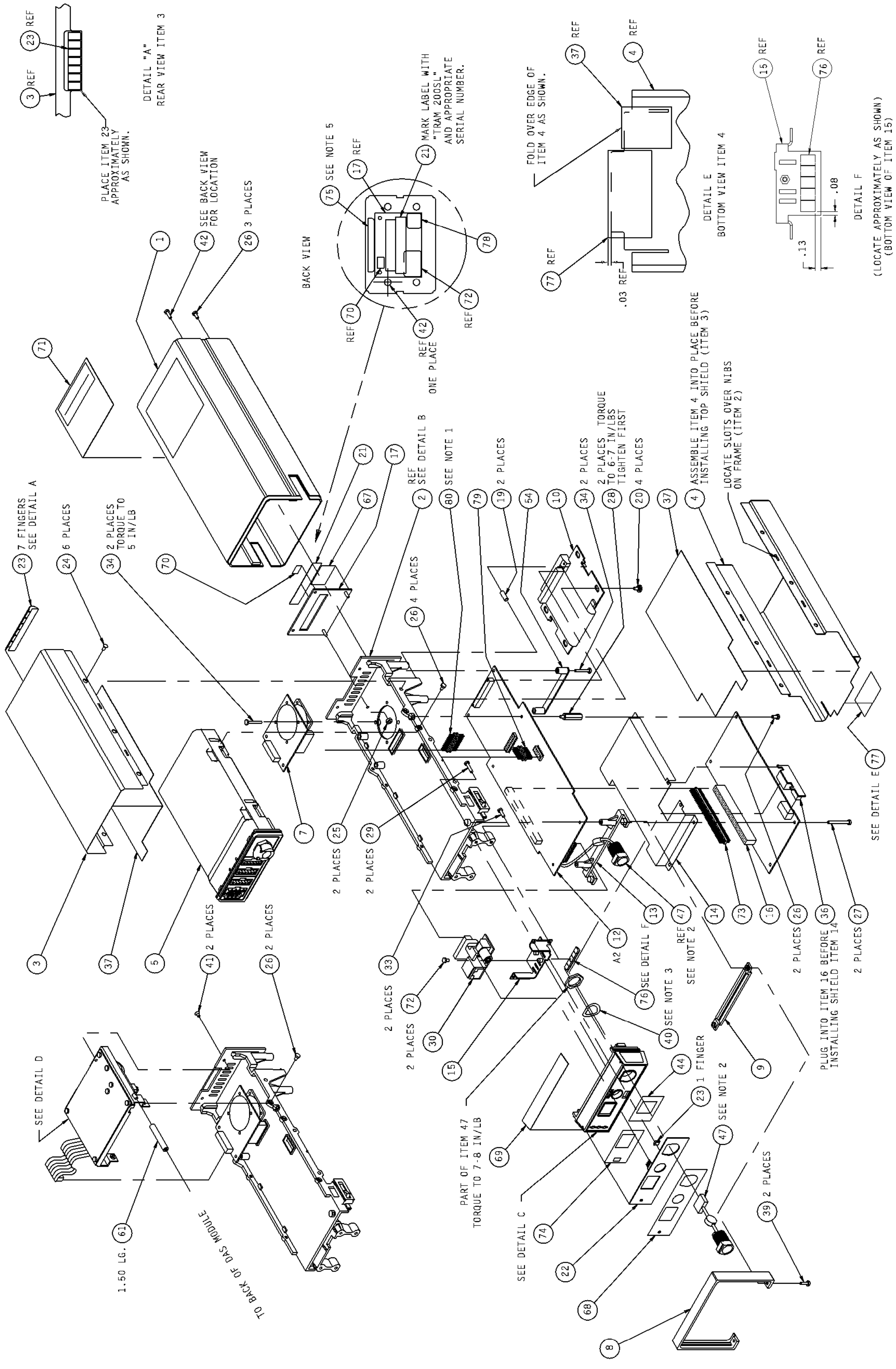
| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 35 | | Label, German PTB | Not Used | 409047-001 | 1 |
| 35 | | Screw, BDGH, 4-40 x 0.188 | 45074-406 | 409009-001 | * |
| 55 | | Label, German PTB | Not Used | 409047-002 | 1 |
| 67 | | Label, Leadwires Warning | Not Used | 414097-001 | * |

**PN 408001B**

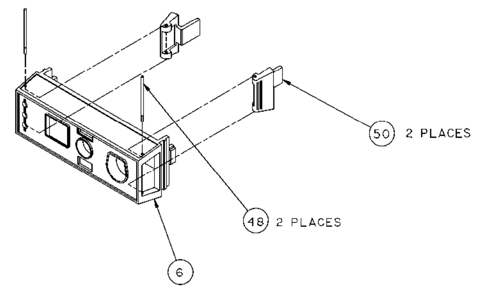
| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 67 | | Label, Leadwires Warning | Not Used | 414097-001 | * |

# Exploded View PN 411160-001H

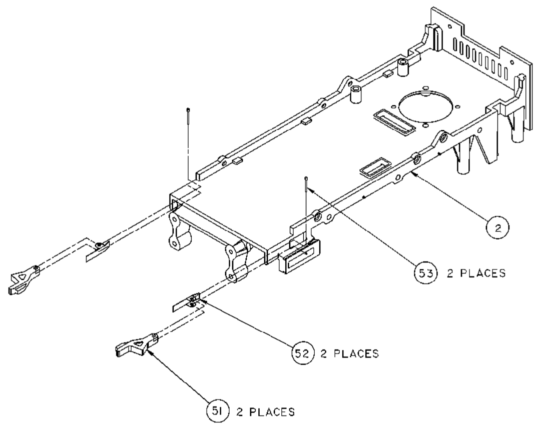
1 of 2


3 REF
23 REF
PLACE ITEM 23 APPROXIMATELY AS SHOWN.
DETAIL "A" REAR VIEW ITEM 3
1
42 SEE BACK VIEW FOR LOCATION
26 3 PLACES
75 SEE NOTE 5
17 REF
21 MARK LABEL WITH "TRAM 200SL" AND APPROPRIATE SERIAL NUMBER.
78
BACK VIEW
REF 70
REF 42 ONE PLACE
REF 72
37 REF
4 REF
FOLD OVER EDGE OF ITEM 4 AS SHOWN.
DETAIL E BOTTOM VIEW ITEM 4
77 REF
.03 REF
15 REF
76 REF
.13
.08
DETAIL F (BOTTOM VIEW OF ITEM 15)
(LOCATE APPROXIMATELY AS SHOWN)
71
23 7 FINGERS SEE DETAIL A
24 6 PLACES
34 2 PLACES TORQUE TO 5 IN/LB
70
21
67
17
2 REF SEE DETAIL B
80 SEE NOTE 1
79
19 2 PLACES
54
10
34 2 PLACES
28 2 PLACES, TORQUE TO 6-7 IN/LBS TIGHTEN FIRST
20 4 PLACES
37
4 ASSEMBLE ITEM 4 INTO PLACE BEFORE INSTALLING TOP SHIELD (ITEM 3)
LOCATE SLOTS OVER NIBS ON FRAME (ITEM 2)
26 4 PLACES
77 SEE DETAIL E
7
25 2 PLACES
29 2 PLACES
3
37
5
41 2 PLACES
26 2 PLACES
33
A2 12
13
REF 47 SEE NOTE 2
SEE DETAIL F
14
73
16
26 2 PLACES
36 PLUG INTO ITEM 16 BEFORE INSTALLING SHIELD ITEM 14
27 2 PLACES
72 2 PLACES
30 2 PLACES
15
76 SEE DETAIL F
40 SEE NOTE 3
9
44 1 FINGER
23
47 SEE NOTE 2
39 2 PLACES
SEE DETAIL D
61 1.50 LG.
TO BACK OF DAS MODULE
PART OF ITEM 47 TORQUE TO 7-8 IN/LB
69
SEE DETAIL C
74
22
68
8

**2 of 2**

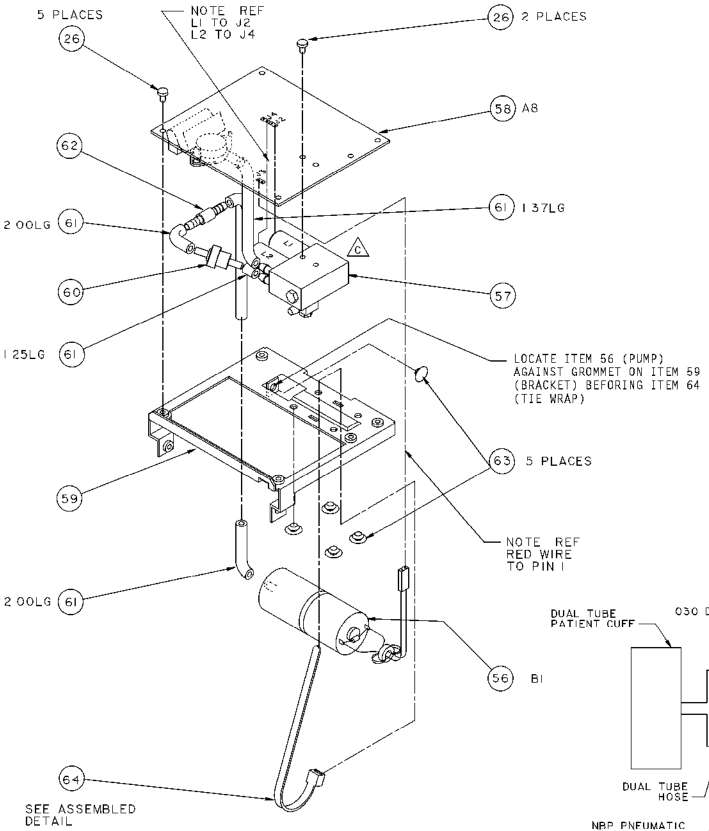

50 2 PLACES
48 2 PLACES
6

DETAIL C


2
53 2 PLACES
52 2 PLACES
51 2 PLACES

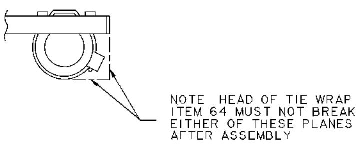
DETAIL B

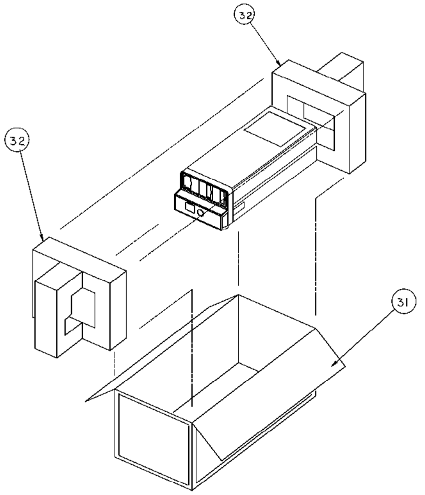
NOTES;
1. INSERT LONGER PIN SIDE INTO ITEM 12. PINS MUST EXTEND BEYOND MATING CONNECTOR ON ITEM 12 WHEN ASSEMBLED.
1. PULSE OXIMETRY CABLE ITEM 47 TO BE ROUTED TO THE INSIDE OF FIRST STANDOFF ON ITEM 13, THEN BEHIND NON-ISO INPUT PCB (ITEM 30) FLEX CIRCUIT CONNECTOR AND LASTLY TO THE INSIDE OF SECOND STANDOFF ON ITEM 13.
3. CURVED WASHER MUST BE INSTALLED CONCAVE SIDE OUT.
4. SWITCH SETTING MUST BE MADE FOR EACH CONFIGURATION. SEE PRODUCT LEVEL NOTE. (REFER TO SWITCH CHART)
5. MARK LABEL ITEM 75, AS FOLLOWS: ZULASSUNGSKENNZEICHEN: 01/M-305/94.
6. CHECK APPROPRIATE BOX ON SIDE OF CARTON TO INDICATE UNIT BEING SHIPPED.
7. LOOSE ITEMS MAY BE SHIPPED WITH THE UNIT IF SPACE PERMITS OR PACKAGED AND SHIPPED SEPARATELY.

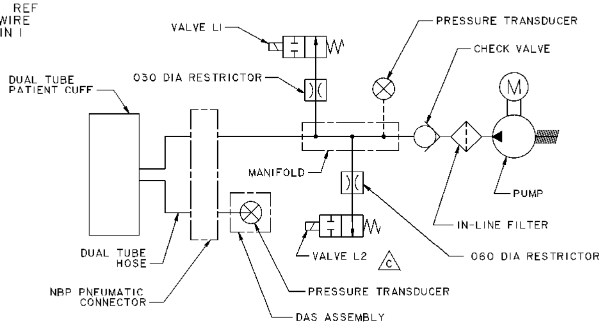

5 PLACES 26
NOTE REF
L1 TO J2
L2 TO J4
26 2 PLACES
58 A8
62
2 00LG 61
61 1 37LG
60
57
C
1 25LG 61
LOCATE ITEM 56 (PUMP)
AGAINST GROMMET ON ITEM 59
(BRACKET) BEFORING ITEM 64
(TIE WRAP)
63 5 PLACES
59
NOTE REF
RED WIRE
TO PIN 1
2 00LG 61
56 B1
64
SEE ASSEMBLED
DETAIL

DETAIL D

ASSEMBLED DETAIL


NOTE HEAD OF TIE WRAP
ITEM 64 MUST NOT BREAK
EITHER OF THESE PLANES
AFTER ASSEMBLY



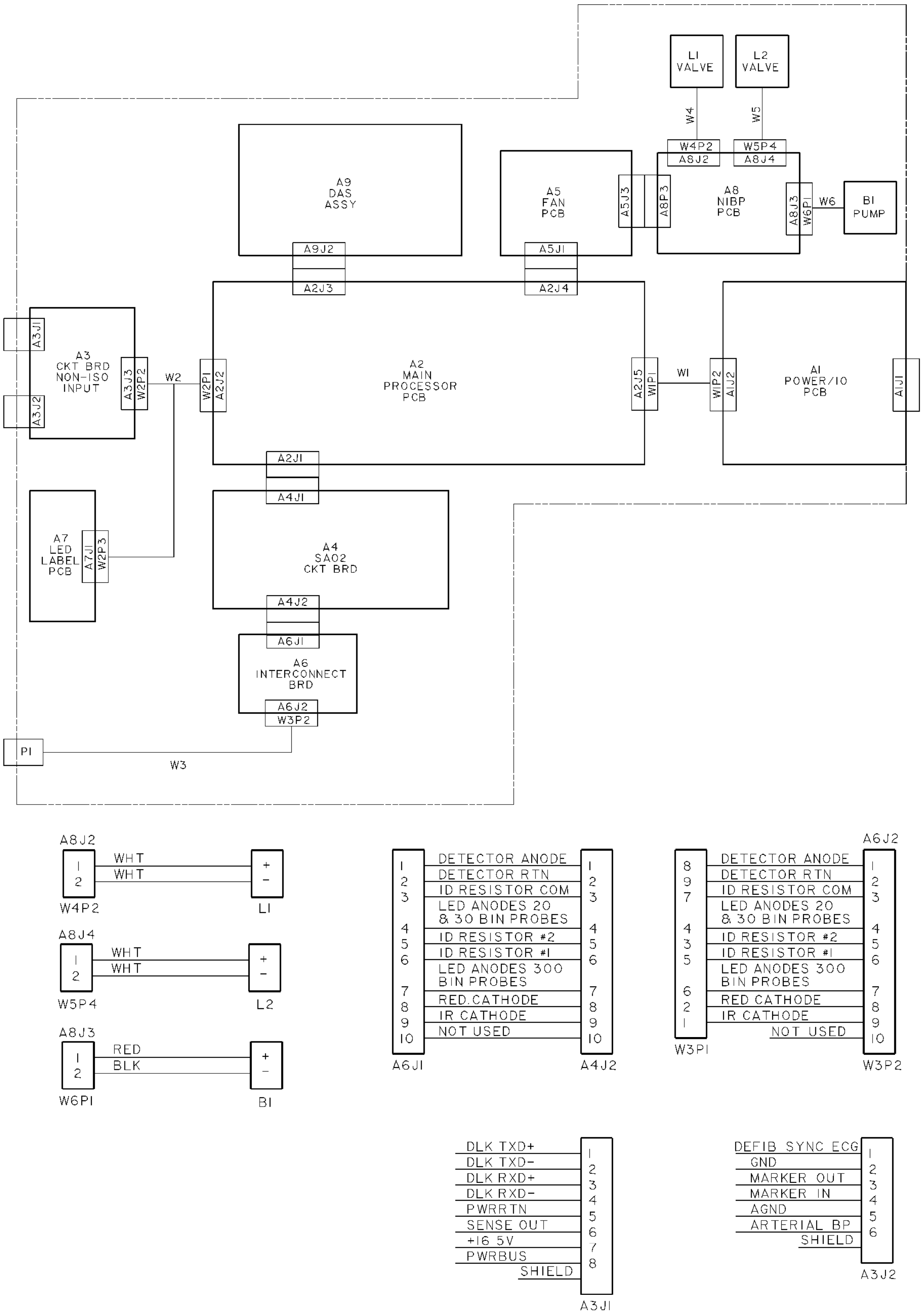

VALVE L1
PRESSURE TRANSDUCER
CHECK VALVE
M
DUAL TUBE
PATIENT CUFF
030 DIA RESTRICTOR
MANIFOLD
PUMP
IN-LINE FILTER
VALVE L2
C
060 DIA RESTRICTOR
DUAL TUBE
HOSE
NBP PNEUMATIC
CONNECTOR
PRESSURE TRANSDUCER
DAS ASSEMBLY

PNEUMATIC SCHEMATIC

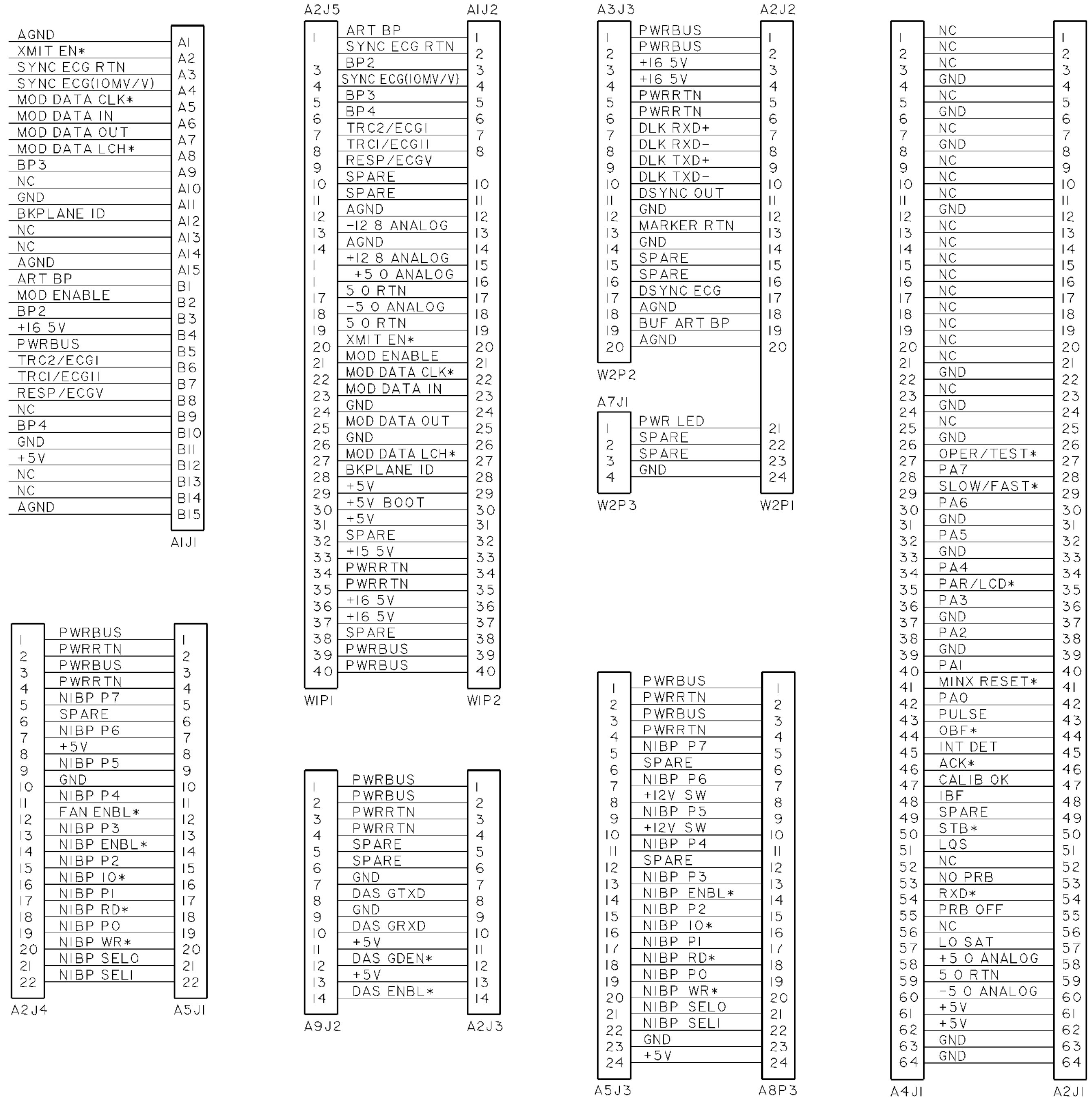
| LEAD IDENT | ITEM NO | FROM | TO |
|---|---|---|---|
| W6 | 56 | W6P1 | A8J3 |
| W4 | 57 | W4P2 | A8J2 |
| W5 | 57 | W5P4 | A8J4 |

# Schematic Diagram PN 411160-001H

1 of 2


L1 VALVE
L2 VALVE
W4
W5
W4P2
A8J2
W5P4
A8J4
A9 DAS ASSY
A5 FAN PCB
A5J3
A8P3
A8 NIBP PCB
A8J3
W6P1
W6
B1 PUMP
A9J2
A2J3
A5J1
A2J4
A3J1
A3 CKT BRD NON-ISO INPUT
A3J3
W2P2
W2
W2P1
A2J2
A2 MAIN PROCESSOR PCB
A2J5
W1P1
W1
W1P2
A1J2
A1 POWER/IO PCB
A1J1
A3J2
A2J1
A4J1
A7 LED LABEL PCB
A7J1
W2P3
A4 SAO2 CKT BRD
A4J2
A6J1
A6 INTERCONNECT BRD
A6J2
W3P2
P1
W3
A8J2
1 WHT +
2 WHT −
W4P2
L1
A8J4
1 WHT +
2 WHT −
W5P4
L2
A8J3
1 RED +
2 BLK −
W6P1
B1
1 DETECTOR ANODE 1
2 DETECTOR RTN 2
3 ID RESISTOR COM 3
LED ANODES 20 & 30 BIN PROBES
4 ID RESISTOR #2 4
5 ID RESISTOR #1 5
6 LED ANODES 300 BIN PROBES 6
7 RED.CATHODE 7
8 IR CATHODE 8
9 NOT USED 9
10
A6J1
A4J2
A6J2
8 DETECTOR ANODE 1
9 DETECTOR RTN 2
7 ID RESISTOR COM 3
LED ANODES 20 & 30 BIN PROBES
4 ID RESISTOR #2 4
3 ID RESISTOR #1 5
5 LED ANODES 300 BIN PROBES 6
6 RED CATHODE 7
2 IR CATHODE 8
1 NOT USED 9
10
W3P1
W3P2
DLK TXD+ 1
DLK TXD− 2
DLK RXD+ 3
DLK RXD− 4
PWRRTN 5
SENSE OUT 6
+16.5V 7
PWRBUS 8
SHIELD
A3J1
DEFIB SYNC ECG 1
GND 2
MARKER OUT 3
MARKER IN 4
AGND 5
ARTERIAL BP 6
SHIELD
A3J2

**2 of 2**



| | A1J1 |
|---|---|
| AGND | A1 |
| XMIT EN* | A2 |
| SYNC ECG RTN | A3 |
| SYNC ECG(10MV/V) | A4 |
| MOD DATA CLK* | A5 |
| MOD DATA IN | A6 |
| MOD DATA OUT | A7 |
| MOD DATA LCH* | A8 |
| BP3 | A9 |
| NC | A10 |
| GND | A11 |
| BKPLANE ID | A12 |
| NC | A13 |
| NC | A14 |
| AGND | A15 |
| ART BP | B1 |
| MOD ENABLE | B2 |
| BP2 | B3 |
| +16 5V | B4 |
| PWRBUS | B5 |
| TRC2/ECGI | B6 |
| TRC1/ECGII | B7 |
| RESP/ECGV | B8 |
| NC | B9 |
| BP4 | B10 |
| GND | B11 |
| +5V | B12 |
| NC | B13 |
| NC | B14 |
| AGND | B15 |

| A2J5 / W1P1 | | A1J2 / W1P2 |
|---|---|---|
| 1 | ART BP | 1 |
| | SYNC ECG RTN | 2 |
| 3 | BP2 | 3 |
| 4 | SYNC ECG(10MV/V) | 4 |
| 5 | BP3 | 5 |
| 6 | BP4 | 6 |
| 7 | TRC2/ECGI | 7 |
| 8 | TRC1/ECGII | 8 |
| 9 | RESP/ECGV | |
| 10 | SPARE | 10 |
| 11 | SPARE | 11 |
| 12 | AGND | 12 |
| 13 | -12 8 ANALOG | 13 |
| 14 | AGND | 14 |
| 1 | +12 8 ANALOG | 15 |
| 1 | +5 0 ANALOG | 16 |
| 17 | 5 0 RTN | 17 |
| 18 | -5 0 ANALOG | 18 |
| 19 | 5 0 RTN | 19 |
| 20 | XMIT EN* | 20 |
| 21 | MOD ENABLE | 21 |
| 22 | MOD DATA CLK* | 22 |
| 23 | MOD DATA IN | 23 |
| 24 | GND | 24 |
| 25 | MOD DATA OUT | 25 |
| 26 | GND | 26 |
| 27 | MOD DATA LCH* | 27 |
| 28 | BKPLANE ID | 28 |
| 29 | +5V | 29 |
| 30 | +5V BOOT | 30 |
| 31 | +5V | 31 |
| 32 | SPARE | 32 |
| 33 | +15 5V | 33 |
| 34 | PWRRTN | 34 |
| 35 | PWRRTN | 35 |
| 36 | +16 5V | 36 |
| 37 | +16 5V | 37 |
| 38 | SPARE | 38 |
| 39 | PWRBUS | 39 |
| 40 | PWRBUS | 40 |

| A3J3 / W2P2 | | A2J2 / W2P1 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRBUS | 2 |
| 3 | +16 5V | 3 |
| 4 | +16 5V | 4 |
| 5 | PWRRTN | 5 |
| 6 | PWRRTN | 6 |
| 7 | DLK RXD+ | 7 |
| 8 | DLK RXD- | 8 |
| 9 | DLK TXD+ | 9 |
| 10 | DLK TXD- | 10 |
| 11 | DSYNC OUT | 11 |
| 12 | GND | 12 |
| 13 | MARKER RTN | 13 |
| 14 | GND | 14 |
| 15 | SPARE | 15 |
| 16 | SPARE | 16 |
| 17 | DSYNC ECG | 17 |
| 18 | AGND | 18 |
| 19 | BUF ART BP | 19 |
| 20 | AGND | 20 |
| **A7J1 / W2P3** | | |
| 1 | PWR LED | 21 |
| 2 | SPARE | 22 |
| 3 | SPARE | 23 |
| 4 | GND | 24 |

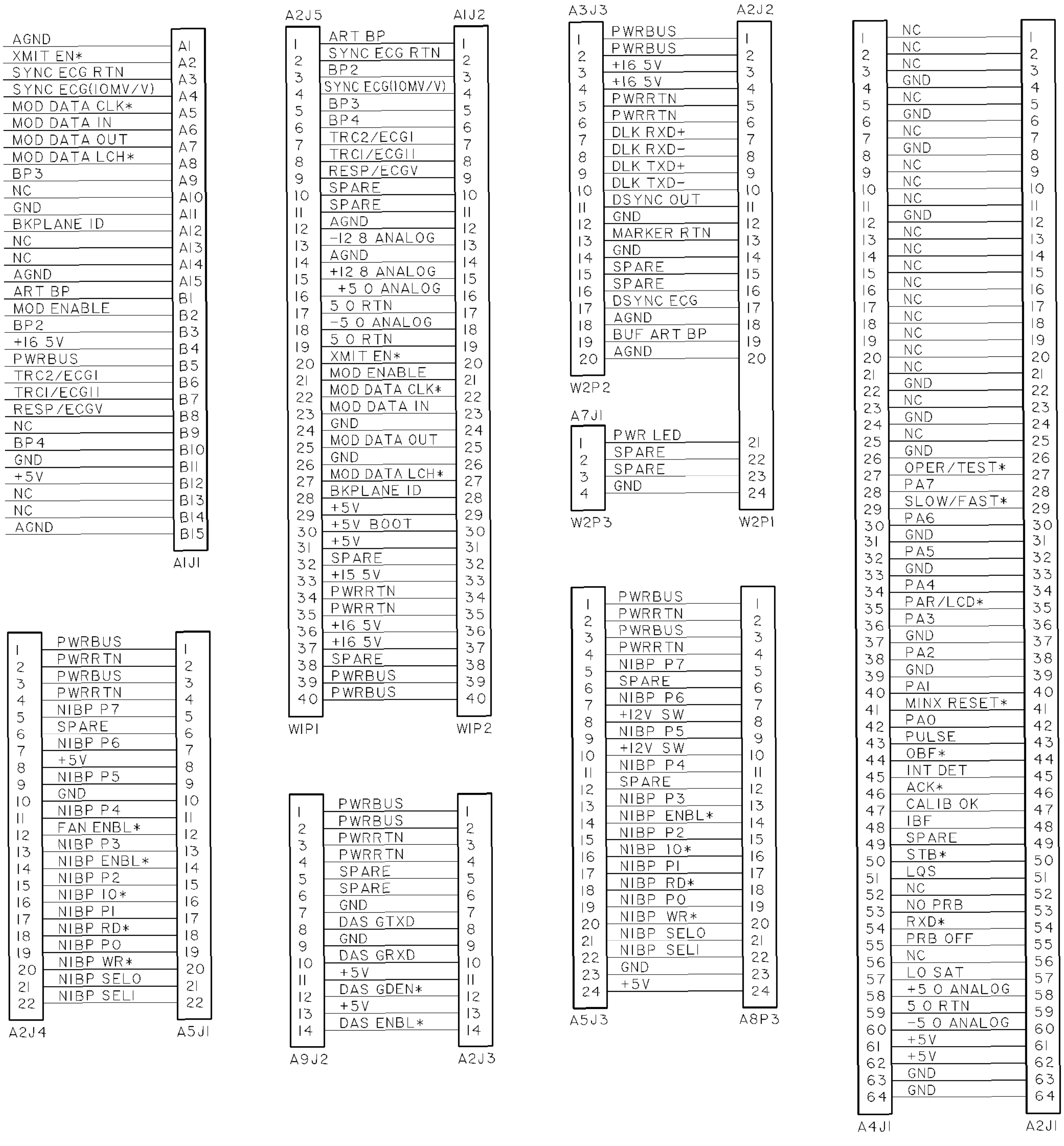
| A4J1 | | A2J1 |
|---|---|---|
| 1 | NC | 1 |
| 2 | NC | 2 |
| 3 | NC | 3 |
| 4 | GND | 4 |
| 5 | NC | 5 |
| 6 | GND | 6 |
| 7 | NC | 7 |
| 8 | GND | 8 |
| 9 | NC | 9 |
| 10 | NC | 10 |
| 11 | NC | 11 |
| 12 | GND | 12 |
| 13 | NC | 13 |
| 14 | NC | 14 |
| 15 | NC | 15 |
| 16 | NC | 16 |
| 17 | NC | 17 |
| 18 | NC | 18 |
| 19 | NC | 19 |
| 20 | NC | 20 |
| 21 | NC | 21 |
| 22 | GND | 22 |
| 23 | NC | 23 |
| 24 | GND | 24 |
| 25 | NC | 25 |
| 26 | GND | 26 |
| 27 | OPER/TEST* | 27 |
| 28 | PA7 | 28 |
| 29 | SLOW/FAST* | 29 |
| 30 | PA6 | 30 |
| 31 | GND | 31 |
| 32 | PA5 | 32 |
| 33 | GND | 33 |
| 34 | PA4 | 34 |
| 35 | PAR/LCD* | 35 |
| 36 | PA3 | 36 |
| 37 | GND | 37 |
| 38 | PA2 | 38 |
| 39 | GND | 39 |
| 40 | PA1 | 40 |
| 41 | MINX RESET* | 41 |
| 42 | PA0 | 42 |
| 43 | PULSE | 43 |
| 44 | OBF* | 44 |
| 45 | INT DET | 45 |
| 46 | ACK* | 46 |
| 47 | CALIB OK | 47 |
| 48 | IBF | 48 |
| 49 | SPARE | 49 |
| 50 | STB* | 50 |
| 51 | LQS | 51 |
| 52 | NC | 52 |
| 53 | NO PRB | 53 |
| 54 | RXD* | 54 |
| 55 | PRB OFF | 55 |
| 56 | NC | 56 |
| 57 | LO SAT | 57 |
| 58 | +5 0 ANALOG | 58 |
| 59 | 5 0 RTN | 59 |
| 60 | -5 0 ANALOG | 60 |
| 61 | +5V | 61 |
| 62 | +5V | 62 |
| 63 | GND | 63 |
| 64 | GND | 64 |

| A2J4 | | A5J1 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRRTN | 2 |
| 3 | PWRBUS | 3 |
| 4 | PWRRTN | 4 |
| 5 | NIBP P7 | 5 |
| 6 | SPARE | 6 |
| 7 | NIBP P6 | 7 |
| 8 | +5V | 8 |
| 9 | NIBP P5 | 9 |
| 10 | GND | 10 |
| 11 | NIBP P4 | 11 |
| 12 | FAN ENBL* | 12 |
| 13 | NIBP P3 | 13 |
| 14 | NIBP ENBL* | 14 |
| 15 | NIBP P2 | 15 |
| 16 | NIBP IO* | 16 |
| 17 | NIBP P1 | 17 |
| 18 | NIBP RD* | 18 |
| 19 | NIBP P0 | 19 |
| 20 | NIBP WR* | 20 |
| 21 | NIBP SEL0 | 21 |
| 22 | NIBP SEL1 | 22 |

| A9J2 | | A2J3 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRBUS | 2 |
| 3 | PWRRTN | 3 |
| 4 | PWRRTN | 4 |
| 5 | SPARE | 5 |
| 6 | SPARE | 6 |
| 7 | GND | 7 |
| 8 | DAS GTXD | 8 |
| 9 | GND | 9 |
| 10 | DAS GRXD | 10 |
| 11 | +5V | 11 |
| 12 | DAS GDEN* | 12 |
| 13 | +5V | 13 |
| 14 | DAS ENBL* | 14 |

| A5J3 | | A8P3 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRRTN | 2 |
| 3 | PWRBUS | 3 |
| 4 | PWRRTN | 4 |
| 5 | NIBP P7 | 5 |
| 6 | SPARE | 6 |
| 7 | NIBP P6 | 7 |
| 8 | +12V SW | 8 |
| 9 | NIBP P5 | 9 |
| 10 | +12V SW | 10 |
| 11 | NIBP P4 | 11 |
| 12 | SPARE | 12 |
| 13 | NIBP P3 | 13 |
| 14 | NIBP ENBL* | 14 |
| 15 | NIBP P2 | 15 |
| 16 | NIBP IO* | 16 |
| 17 | NIBP P1 | 17 |
| 18 | NIBP RD* | 18 |
| 19 | NIBP P0 | 19 |
| 20 | NIBP WR* | 20 |
| 21 | NIBP SEL0 | 21 |
| 22 | NIBP SEL1 | 22 |
| 23 | GND | 23 |
| 24 | +5V | 24 |

**2 of 2**



| A1J1 pin | Signal |
|---|---|
| A1 | AGND |
| A2 | XMIT EN* |
| A3 | SYNC ECG RTN |
| A4 | SYNC ECG(10MV/V) |
| A5 | MOD DATA CLK* |
| A6 | MOD DATA IN |
| A7 | MOD DATA OUT |
| A8 | MOD DATA LCH* |
| A9 | BP3 |
| A10 | NC |
| A11 | GND |
| A12 | BKPLANE ID |
| A13 | NC |
| A14 | NC |
| A15 | AGND |
| B1 | ART BP |
| B2 | MOD ENABLE |
| B3 | BP2 |
| B4 | +16 5V |
| B5 | PWRBUS |
| B6 | TRC2/ECGI |
| B7 | TRC1/ECGII |
| B8 | RESP/ECGV |
| B9 | NC |
| B10 | BP4 |
| B11 | GND |
| B12 | +5V |
| B13 | NC |
| B14 | NC |
| B15 | AGND |

| A2J5 / W1P1 | Signal | A1J2 / W1P2 |
|---|---|---|
| 1 | ART BP | 1 |
| 2 | SYNC ECG RTN | 2 |
| 3 | BP2 | 3 |
| 4 | SYNC ECG(10MV/V) | 4 |
| 5 | BP3 | 5 |
| 6 | BP4 | 6 |
| 7 | TRC2/ECGI | 7 |
| 8 | TRC1/ECGII | 8 |
| 9 | RESP/ECGV | 9 |
| 10 | SPARE | 10 |
| 11 | SPARE | 11 |
| 12 | AGND | 12 |
| 13 | -12 8 ANALOG | 13 |
| 14 | AGND | 14 |
| 15 | +12 8 ANALOG | 15 |
| 16 | +5 0 ANALOG | 16 |
| 17 | 5 0 RTN | 17 |
| 18 | -5 0 ANALOG | 18 |
| 19 | 5 0 RTN | 19 |
| 20 | XMIT EN* | 20 |
| 21 | MOD ENABLE | 21 |
| 22 | MOD DATA CLK* | 22 |
| 23 | MOD DATA IN | 23 |
| 24 | GND | 24 |
| 25 | MOD DATA OUT | 25 |
| 26 | GND | 26 |
| 27 | MOD DATA LCH* | 27 |
| 28 | BKPLANE ID | 28 |
| 29 | +5V | 29 |
| 30 | +5V BOOT | 30 |
| 31 | +5V | 31 |
| 32 | SPARE | 32 |
| 33 | +15 5V | 33 |
| 34 | PWRRTN | 34 |
| 35 | PWRRTN | 35 |
| 36 | +16 5V | 36 |
| 37 | +16 5V | 37 |
| 38 | SPARE | 38 |
| 39 | PWRBUS | 39 |
| 40 | PWRBUS | 40 |

| A3J3 / W2P2 | Signal | A2J2 / W2P1 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRBUS | 2 |
| 3 | +16 5V | 3 |
| 4 | +16 5V | 4 |
| 5 | PWRRTN | 5 |
| 6 | PWRRTN | 6 |
| 7 | DLK RXD+ | 7 |
| 8 | DLK RXD- | 8 |
| 9 | DLK TXD+ | 9 |
| 10 | DLK TXD- | 10 |
| 11 | DSYNC OUT | 11 |
| 12 | GND | 12 |
| 13 | MARKER RTN | 13 |
| 14 | GND | 14 |
| 15 | SPARE | 15 |
| 16 | SPARE | 16 |
| 17 | DSYNC ECG | 17 |
| 18 | AGND | 18 |
| 19 | BUF ART BP | 19 |
| 20 | AGND | 20 |

| A7J1 / W2P3 | Signal | A2J2 / W2P1 |
|---|---|---|
| 1 | PWR LED | 21 |
| 2 | SPARE | 22 |
| 3 | SPARE | 23 |
| 4 | GND | 24 |

| A2J4 | Signal | A5J1 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRRTN | 2 |
| 3 | PWRBUS | 3 |
| 4 | PWRRTN | 4 |
| 5 | NIBP P7 | 5 |
| 6 | SPARE | 6 |
| 7 | NIBP P6 | 7 |
| 8 | +5V | 8 |
| 9 | NIBP P5 | 9 |
| 10 | GND | 10 |
| 11 | NIBP P4 | 11 |
| 12 | FAN ENBL* | 12 |
| 13 | NIBP P3 | 13 |
| 14 | NIBP ENBL* | 14 |
| 15 | NIBP P2 | 15 |
| 16 | NIBP IO* | 16 |
| 17 | NIBP P1 | 17 |
| 18 | NIBP RD* | 18 |
| 19 | NIBP P0 | 19 |
| 20 | NIBP WR* | 20 |
| 21 | NIBP SEL0 | 21 |
| 22 | NIBP SEL1 | 22 |

| A9J2 | Signal | A2J3 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRBUS | 2 |
| 3 | PWRRTN | 3 |
| 4 | PWRRTN | 4 |
| 5 | SPARE | 5 |
| 6 | SPARE | 6 |
| 7 | GND | 7 |
| 8 | DAS GTXD | 8 |
| 9 | GND | 9 |
| 10 | DAS GRXD | 10 |
| 11 | +5V | 11 |
| 12 | DAS GDEN* | 12 |
| 13 | +5V | 13 |
| 14 | DAS ENBL* | 14 |

| A5J3 | Signal | A8P3 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRRTN | 2 |
| 3 | PWRBUS | 3 |
| 4 | PWRRTN | 4 |
| 5 | NIBP P7 | 5 |
| 6 | SPARE | 6 |
| 7 | NIBP P6 | 7 |
| 8 | +12V SW | 8 |
| 9 | NIBP P5 | 9 |
| 10 | +12V SW | 10 |
| 11 | NIBP P4 | 11 |
| 12 | SPARE | 12 |
| 13 | NIBP P3 | 13 |
| 14 | NIBP ENBL* | 14 |
| 15 | NIBP P2 | 15 |
| 16 | NIBP IO* | 16 |
| 17 | NIBP P1 | 17 |
| 18 | NIBP RD* | 18 |
| 19 | NIBP P0 | 19 |
| 20 | NIBP WR* | 20 |
| 21 | NIBP SEL0 | 21 |
| 22 | NIBP SEL1 | 22 |
| 23 | GND | 23 |
| 24 | +5V | 24 |

| A4J1 | Signal | A2J1 |
|---|---|---|
| 1 | NC | 1 |
| 2 | NC | 2 |
| 3 | NC | 3 |
| 4 | GND | 4 |
| 5 | NC | 5 |
| 6 | GND | 6 |
| 7 | NC | 7 |
| 8 | GND | 8 |
| 9 | NC | 9 |
| 10 | NC | 10 |
| 11 | NC | 11 |
| 12 | GND | 12 |
| 13 | NC | 13 |
| 14 | NC | 14 |
| 15 | NC | 15 |
| 16 | NC | 16 |
| 17 | NC | 17 |
| 18 | NC | 18 |
| 19 | NC | 19 |
| 20 | NC | 20 |
| 21 | NC | 21 |
| 22 | GND | 22 |
| 23 | NC | 23 |
| 24 | GND | 24 |
| 25 | NC | 25 |
| 26 | GND | 26 |
| 27 | OPER/TEST* | 27 |
| 28 | PA7 | 28 |
| 29 | SLOW/FAST* | 29 |
| 30 | PA6 | 30 |
| 31 | GND | 31 |
| 32 | PA5 | 32 |
| 33 | GND | 33 |
| 34 | PA4 | 34 |
| 35 | PAR/LCD* | 35 |
| 36 | PA3 | 36 |
| 37 | GND | 37 |
| 38 | PA2 | 38 |
| 39 | GND | 39 |
| 40 | PA1 | 40 |
| 41 | MINX RESET* | 41 |
| 42 | PA0 | 42 |
| 43 | PULSE | 43 |
| 44 | OBF* | 44 |
| 45 | INT DET | 45 |
| 46 | ACK* | 46 |
| 47 | CALIB OK | 47 |
| 48 | IBF | 48 |
| 49 | SPARE | 49 |
| 50 | STB* | 50 |
| 51 | LQS | 51 |
| 52 | NC | 52 |
| 53 | NO PRB | 53 |
| 54 | RXD* | 54 |
| 55 | PRB OFF | 55 |
| 56 | NC | 56 |
| 57 | LO SAT | 57 |
| 58 | +5 0 ANALOG | 58 |
| 59 | 5 0 RTN | 59 |
| 60 | -5 0 ANALOG | 60 |
| 61 | +5V | 61 |
| 62 | +5V | 62 |
| 63 | GND | 63 |
| 64 | GND | 64 |

# Parts List PN 411160-001H

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 1 | | Cover, Module | 400895-001 | 1 |
| 2 | | Frame | 400982-001 | 1 |
| 3 | | Shield, Top | 401679-001 | 1 |
| 4 | | Shield, Bottom | 401679-002 | 1 |
| 5 | A9 | 200 Acquisition Module, 10-Lead | 417120-001 | 1 |
| 6 | | Front Bezel, Lower | 401105-004 | 1 |
| 7 | A5 | Fan PCB | 403549-002 | 1 |
| 8 | | Trim, Rubber, Front Bezel | 404620-001 | 1 |
| 9 | | Mounting Strap, Trim | 404621-001 | 1 |
| 10 | A1 | Power Supply PCB | 401309-002 | 1 |
| 12 | A2 | Module Processor PCB | 800210-005 | 1 |
| 13 | | Circuit Board/Bezel Mount | 404672-001 | 1 |
| 14 | | Shield, Pulse Oximetry PCB | 401680-001 | 1 |
| 15 | | Plate, Chassis Ground, Bottom/Front | 402317-001 | 1 |
| 16 | A4 | Pulse Oximetry PCB | 401189-001 | 1 |
| 17 | | Plate, Chassis Ground, Rear | 404680-002 | 1 |
| 19 | | Spring, Compression | 402315-001 | 2 |
| 20 | | Screw, Power Supply PCB Mounting, SST, 4-40 | 402214-001 | 4 |
| 21 | | Label, Model/Serial Number | 404525-006 | 1 |
| 22 | A7 | Power Indicator PCB | 403170-008 | 1 |
| 23 | | Spring, Chassis Ground, Rear | 403741-001 | AR |
| 24 | | Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16 | 4505-406 | 6 |
| 25 | | Nut, Hex, 4-40 | 4521-304 | 2 |
| 26 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 45074-406 | 17 |
| 27 | | Screw, BDGH, Phillips, 4-40 x 1-3/8 | 45074-438 | 2 |
| 28 | | Spacer, Male/Female, 4-40 x 0.875 | 4656-414 | 2 |
| 29 | | Screw, 4-40 x 7/8 | 404069-001 | 2 |
| 30 | A3, W2 | Non-Isolated Input PCB | 401315-002 | 1 |
| 31 | | Carton, Shipping | 404211-003 | 1 |
| 32 | | Foam Insert | 404211-004 | 2 |
| 33 | | Screw, BDGH, Phillips, 4-40 x 5/8 | 45074-420 | 2 |
| 34 | | Screw, BDGH, Phillips, 4-40 x 3/4 | 45074-424 | 4 |
| 36 | A6 | Interconnect PCB | 800006-001 | 1 |
| 37 | | Insulator, Bottom Shield | 404188-001 | 2 |
| 39 | | Screw, BDGH, Phillips, 4-40 x 3/8 | 45074-412 | 2 |
| 40 | | Washer, Pulse Oximetry Connector | 4550-250 | 1 |
| 41 | | Screw, FLH, Phillips, SST, 4-40 x 3/8 | 4505-412 | 2 |
| 42 | | Screw, PNH, 4-40 x 0.188, Modified (Determined by Destination) | 409009-001 | 1 |
| 42 | | Screw, BDGH, 4-40 x 0.188 (Determined by Destination) | 45075-406 | 1 |

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 43 | | Tram 100 - 850 A and SL Module Service Manual | 404422-065 | – |
| 44 | | Adhesive, Diecut, Right Front | 415098-001 | AR |
| 47 | W3 | Harness Assembly, SpO2 – w/Choke | 700091-004 | 1 |
| 48 | | Pin, Latch | 402806-001 | 2 |
| 50 | | Button, Latch | 402106-001 | 2 |
| 51 | | Latch | 401682-001 | 2 |
| 52 | | Spring, Latch | 406019-001 | 2 |
| 53 | | Pin, Latch | 406037-001 | 2 |
| 54 | | Bracket, Power Supply PCB | 406254-001 | 1 |
| 56 | B1, W6 | Pump Assembly, NBP, w/Harness | 408169-002 | 1 |
| 57 | V1, V2, W4, W5 | NBP Valve Assembly | 416153-001 | 1 |
| 58 | A8 | NBP PCB | 800316-002 | 1 |
| 59 | | Bracket, NBP Mounting | 404296-001 | 1 |
| 60 | | Check Valve, 0.125 ID | 404675-001 | 1 |
| 61 | | Tubing, Silastic | 401582-001 | AR |
| 62 | | Filter, 43 Micron | 404679-001 | 1 |
| 63 | | Grommet, 1/4 Dia, 1/8 High, 1/16 Panel Thickness | 404749-001 | 5 |
| 64 | | Tie Wrap | 4535-002 | 1 |
| 67 | | Label, TUV (Determined by Destination) | 408103-003 | 1 |
| 67 | | Label, UL (Determined by Destination) | 408230-001 | 1 |
| 68 | | Label, Front, 200SL, English (Determined by Destination) | 411173-002 | 1 |
| 68 | | Label, Front, 200SL, German (Determined by Destination) | 411173-003 | 1 |
| 68 | | Label, Front, 200SL, French (Determined by Destination) | 411173-004 | 1 |
| 68 | | Label, Front, 200SL, Swedish (Determined by Destination) | 411173-005 | 1 |
| 68 | | Label, Front, 200SL, Spanish (Determined by Destination) | 411173-006 | 1 |
| 68 | | Label, Front, 200SL, Italian (Determined by Destination) | 411173-007 | 1 |
| 69 | | Label, Top, English (Determined by Destination) | 411173-009 | 1 |
| 69 | | Label, Top, German (Determined by Destination) | 411173-010 | 1 |
| 69 | | Label, Top, French (Determined by Destination) | 411173-011 | 1 |
| 69 | | Label, Top, Swedish (Determined by Destination) | 411173-012 | 1 |
| 69 | | Label, Top, Spanish (Determined by Destination) | 411173-013 | 1 |
| 69 | | Label, Top, Italian (Determined by Destination) | 411173-014 | 1 |
| 71 | | Label, Cover, English (Determined by Destination) | 411173-016 | 1 |
| 71 | | Label, Cover, German (Determined by Destination) | 411173-020 | 1 |
| 71 | | Label, Cover, French (Determined by Destination) | 411173-021 | 1 |
| 71 | | Label, Cover, Swedish (Determined by Destination) | 411173-022 | 1 |
| 71 | | Label, Cover, Spanish (Determined by Destination) | 411173-023 | 1 |
| 71 | | Label, Cover, French (Determined by Destination) | 411173-024 | 1 |

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 71 | | Label, Cover, International (Determined by Destination) | 411173-025 | 1 |
| 72 | | Screw, PNH, Phillips, SST, 4-40 x 3/16 | 4502-406 | 2 |
| 73 | P1 | Connector, Header, 64-Pin, w/Ferrites | 409203-001 | 1 |
| 74 | | Adhesive, Diecut, Front Left | 415098-002 | 1 |
| 76 | | Spring, Chassis Ground, Small | 414610-001 | AR |
| 77 | | Adhesive, Mylar | 415316-001 | 1 |
| 78 | | Label, CE Mark | 408230-008 | 1 |
| 79 | | PC Post, 2 x 7 | 412062-004 | 1 |
| 80 | | PC Post, 2 x 11 | 412062-005 | 1 |

# Assembly Revisions PN 411160

The baseline revision for this assembly is pn 411160-001G. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

**PN 411160-001A**

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 5 | A9 | DAS 200 Module, 10-Lead | 411166-001 | 417120-001 | 1 |
| 11 | | Label Set, Tram 200SL | 411173-001 | Not Used | 1 |
| 12 | | Module Processor PCB | 800210-002 | 800210-005 | 1 |
| 42 | | Adhesive, Loctite Prism 411 | 4851-082 | 415098-001 | AR |
| 46 | | Bezel Kit, Front | 407721-004 | Not Used | 1 |
| 57 | V1, V2, W4, W5 | NBP Tram Valve Assembly | 404459-001 | 416153-001 | 1 |
| 58 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |
| 72 | | Screw, Phillips, STT, 4-40 x 3/16 | Not Used | 4502-406 | 2 |
| 73 | | Connector, Header 64-pin w/Ferrites | Not Used | 409203-001 | 1 |
| 74 | | Adhesive, Diecut Front Left | Not Used | 415098-002 | 1 |
| 76 | | Spring, Chassis Ground, Small | Not Used | 414610-001 | AR |
| 77 | | Adhesive, Mylar | Not Used | 415316-001 | 1 |
| 78 | | Label, CE Mark | Not Used | 408230-008 | 1 |
| 79 | | PC Post, 2 x 7 | Not Used | 412062-004 | 1 |
| 80 | | PC Post, 2 x 11 | Not Used | 412062-005 | 1 |

## PN 411160-001B

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 5 | A9 | DAS 200 Module, 10-Lead | 411166-001 | 417120-001 | 1 |
| 11 | | Label Set, Tram 200SL | 411173-001 | Not Used | 1 |
| 12 | | Module Processor PCB | 800210-002 | 800210-005 | 1 |
| 42 | | Adhesive, Loctite Prism 411 | 4851-082 | 415098-001 | AR |
| 46 | | Bezel Kit, Front | 407721-004 | Not Used | 1 |
| 57 | V1, V2, W4, W5 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 58 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |
| 72 | | Screw, Phillips, STT, 4-40 x 3/16 | Not Used | 4502-406 | 2 |
| 73 | | Connector, Header 64-pin w/Ferrites | Not Used | 409203-001 | 1 |
| 74 | | Adhesive, Diecut Front Left | Not Used | 415098-002 | 1 |
| 76 | | Spring, Chassis Ground, Small | Not Used | 414610-001 | AR |
| 77 | | Adhesive, Mylar | Not Used | 415316-001 | 1 |
| 78 | | Label, CE Mark | Not Used | 408230-008 | 1 |
| 79 | | PC Post, 2 x 7 | Not Used | 412062-004 | 1 |
| 80 | | PC Post, 2 x 11 | Not Used | 412062-005 | 1 |

## PN 411160-001C

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 5 | A9 | DAS 200 Module, 10-Lead | 411166-001 | 417120-001 | 1 |
| 12 | | Module Processor PCB | 800210-002 | 800210-005 | 1 |
| 42 | | Adhesive, Loctite Prism 411 | 4851-082 | 415098-001 | AR |
| 57 | V1, V2, W4, W5 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 58 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |
| 74 | | Adhesive, Diecut Front Left | Not Used | 415098-002 | 1 |
| 76 | | Spring, Chassis Ground, Small | Not Used | 414610-001 | AR |
| 77 | | Adhesive, Mylar | Not Used | 415316-001 | 1 |
| 78 | | Label, CE Mark | Not Used | 408230-008 | 1 |
| 79 | | PC Post, 2 x 7 | Not Used | 412062-004 | 1 |
| 80 | | PC Post, 2 x 11 | Not Used | 412062-005 | 1 |

## PN 411160-001D

This revision was a documentation change that does not affect this manual.
Refer to pn 411160-001C for changes to the parts list.

## PN 411160-001E

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 5 | A9 | DAS 200 Module, 10-Lead | 411166-001 | 417120-001 | 1 |
| 12 | | Module Processor PCB | 800210-002 | 800210-005 | 1 |
| 57 | V1, V2, W4, W5 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 58 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |
| 76 | | Spring, Chassis Ground, Small | Not Used | 414610-001 | AR |
| 77 | | Adhesive, Mylar | Not Used | 415316-001 | 1 |
| 78 | | Label, CE Mark | Not Used | 408230-008 | 1 |
| 79 | | PC Post, 2 x 7 | Not Used | 412062-004 | 1 |
| 80 | | PC Post, 2 x 11 | Not Used | 412062-005 | 1 |

## PN 411160-001F

This revision was a documentation change that does not affect this manual.
Refer to pn 411160-001E for changes to the parts list.

## PN 411160-001G

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 5 | A9 | DAS 200 Module, 10-Lead | 411166-001 | 417120-001 | 1 |
| 57 | V1, V2, W4, W5 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 58 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |

# 9 TRAM 250SL MODULE

# PN 412651

**General** .......................................................... **9-2**
    Circuit Boards .......................................................... 9-2

**Exploded View PN 412651-001H** .......................................................... **9-3**

**Schematic Diagram PN 412651-001H** .......................................................... **9-5**

**Parts List PN 412651-001H** .......................................................... **9-7**

**Assembly Revisions PN 412651** .......................................................... **9-10**

# General

## Circuit Boards

Details about the circuit boards contained in the Tram 250SL are discussed in later chapters arranged by part number.

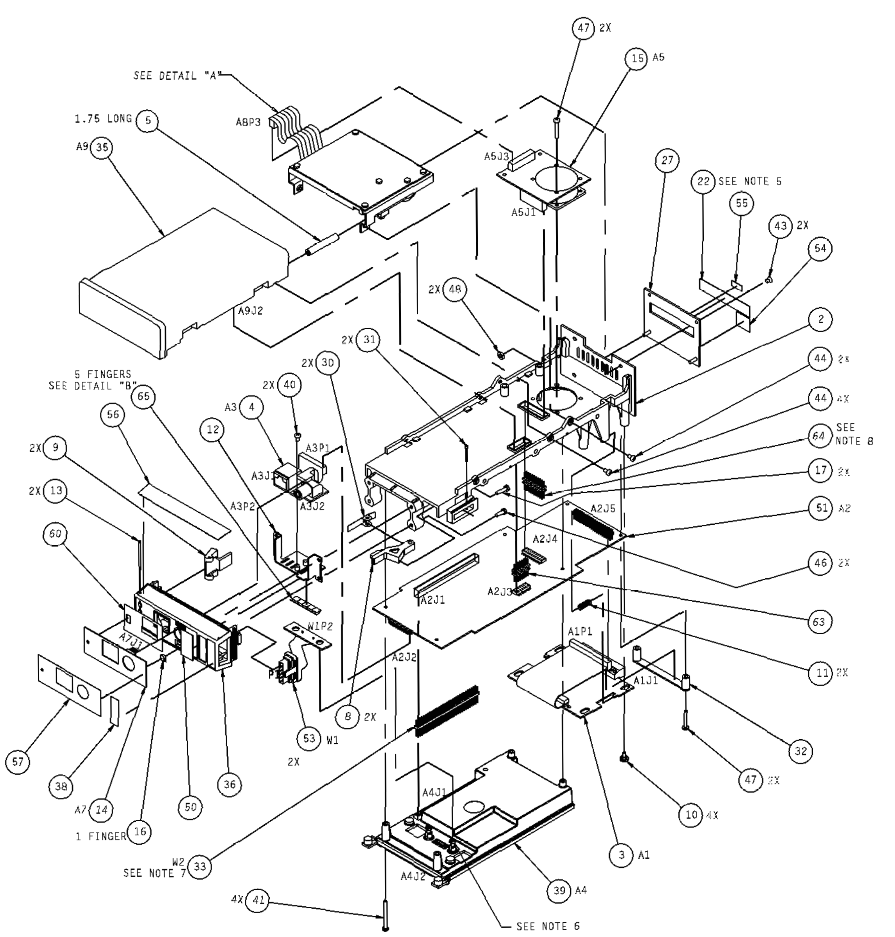
**Table 8-1. Circuit Board Overview**

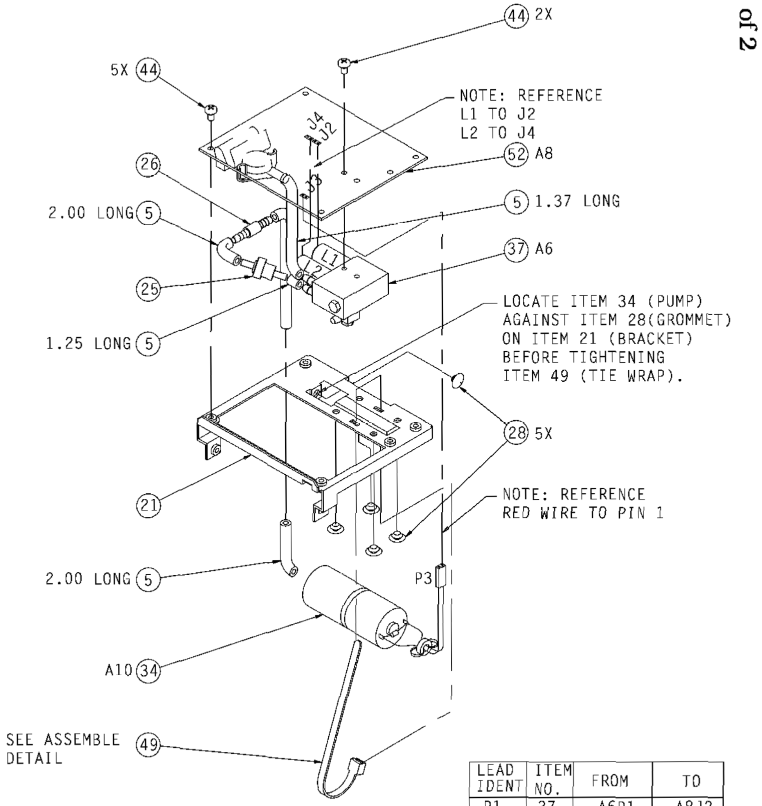
| Module Type | Upper Level | Leadwire Configuration | DAS Module | Acquisition Processor PCB | Module Processor PCB |
|---|---|---|---|---|---|
| Tram 250SL | 412651-001A–G | 10-Leadwire | 411166-001 | 800330-006 | 800210-005 |
| Tram 250SL | 412651-001H | 10-Leadwire | 417120-001<br>(Replaced 411166-001) | 801040-001 | 800210-005 |

# Exploded View

# PN 412651-001H

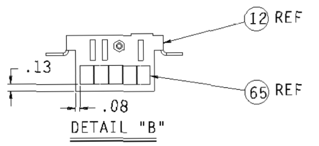
1 of 2


(47) 2X
(15) A5
SEE DETAIL "A"
1.75 LONG (5)
A9 (35)
A8P3
A5J3
A5J1
(27)
(22) SEE NOTE 5
(55)
(43) 2X
(54)
A9J2
2X (48)
(2)
2X (31)
2X (30)
(44) 2X
(44) 4X
(64) SEE NOTE 8
(17) 2X
(51) A2
5 FINGERS SEE DETAIL "B"
(65)
(56)
2X (40)
A3 (4)
(12)
A3P1
A3J1
A3J2
A3P2
2X (9)
2X (13)
(60)
A2J5
A2J4
A2J3
A2J1
A2J2
A7J1
W1P2
A1P1
A1J1
(46) 2X
(63)
(11) 2X
(53) W1
2X
(8) 2X
(32)
(47) 2X
(10) 4X
(57)
(38)
A7 (14)
1 FINGER (16)
(50)
(36)
W2 SEE NOTE 7 (33)
A4J1
A4J2
(3) A1
(39) A4
4X (41)
SEE NOTE 6


(44) 2X
5X (44)
NOTE: REFERENCE L1 TO J2 L2 TO J4
J4
J2
L1
(52) A8
(26)
2.00 LONG (5)
(5) 1.37 LONG
(37) A6
(25)
1.25 LONG (5)
LOCATE ITEM 34 (PUMP) AGAINST ITEM 28(GROMMET) ON ITEM 21 (BRACKET) BEFORE TIGHTENING ITEM 49 (TIE WRAP).
(28) 5X
(21)
NOTE: REFERENCE RED WIRE TO PIN 1
2.00 LONG (5)
P3
A10 (34)
SEE ASSEMBLE DETAIL (49)

| LEAD IDENT | ITEM NO. | FROM | TO |
|---|---|---|---|
| P1 | 37 | A6P1 | A8J2 |
| P2 | 37 | A6P2 | A8J4 |
| P3 | 34 | A10P3 | A8J3 |

DETAIL "A"

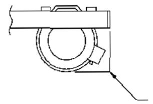

(12) REF
(65) REF
.13
.08

DETAIL "B"

(LOCATE APPROXIMATELY AS SHOWN)
(BOTTOM VIEW OF ITEM 12)

NOTES:

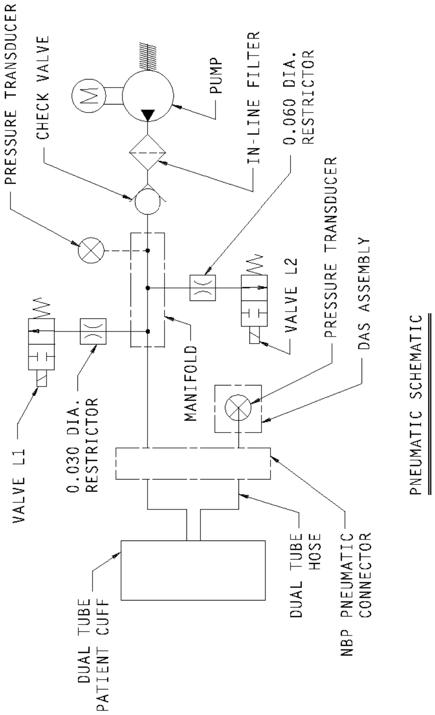
1. *WHEN SHIELD (ITEM 7) IS INSTALLED, THE TAB SHOULD TUCK INTO THE* FRONT BEZEL (ITEM 36) AND BE IN CONTACT WITH THE SHIELDING FINGERS (ITEM 16) ON THE BOTTOM OF THE BRACKET (ITEM 12).
2. SWITCH SETTINGS MUST BE MADE FOR EACH CONFIGURATION (SEE SWITCH CHART SHEET 2).
3. CHECK APPROPRIATE BOX ON SIDE OF CARTON TO INDICATE UNIT BEING SHIPPED.
4. *LOOSE ITEMS MAY BE SHIPPED WITH THE UNIT IF SPACE PERMITS OR PACKAGED AND* SHIPPED SEPARATELY.
5. MARK LABEL WITH MODEL NUMBER, SERIAL NUMBER, AND BAR CODE.
6. INSERT TWO HOLES OF FLEX PCB (ITEM 53) ONTO 1/4-TURN STANDOFF (ITEM 39) UNTIL CONNECTOR ON PCB FLEX BOTTOMS OUT. THEN LOCK THE STANDOFFS BY TURNING THE HEX SCREW OF THE STANDOFF 1/4-TURN CLOCKWISE.
7. INSERT THE SHORT LEADS OF CONNECTOR (ITEM 33) INTO PCB TRAM CPU (ITEM 51).
8. INSERT LONGER PIN SIDE INTO ITEM 51. PINS MUST EXTEND BEYOND MATING CONNECTOR ON ITEM 51 WHEN ASSEMBLED.

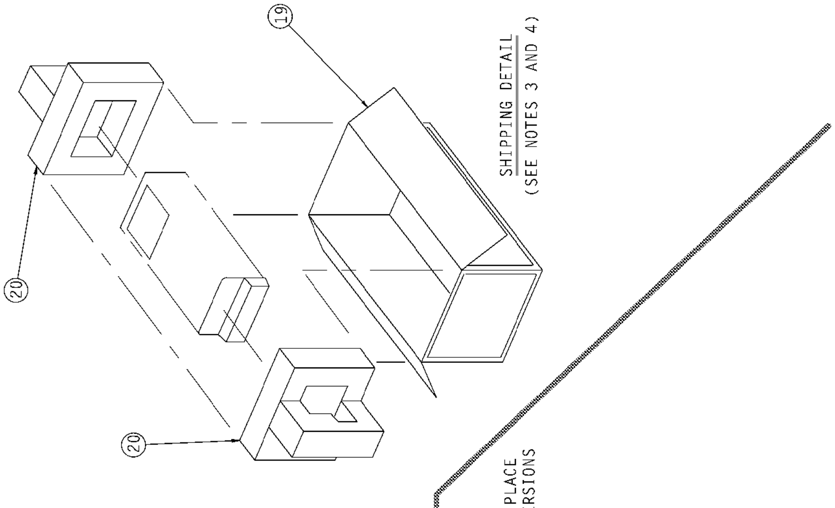


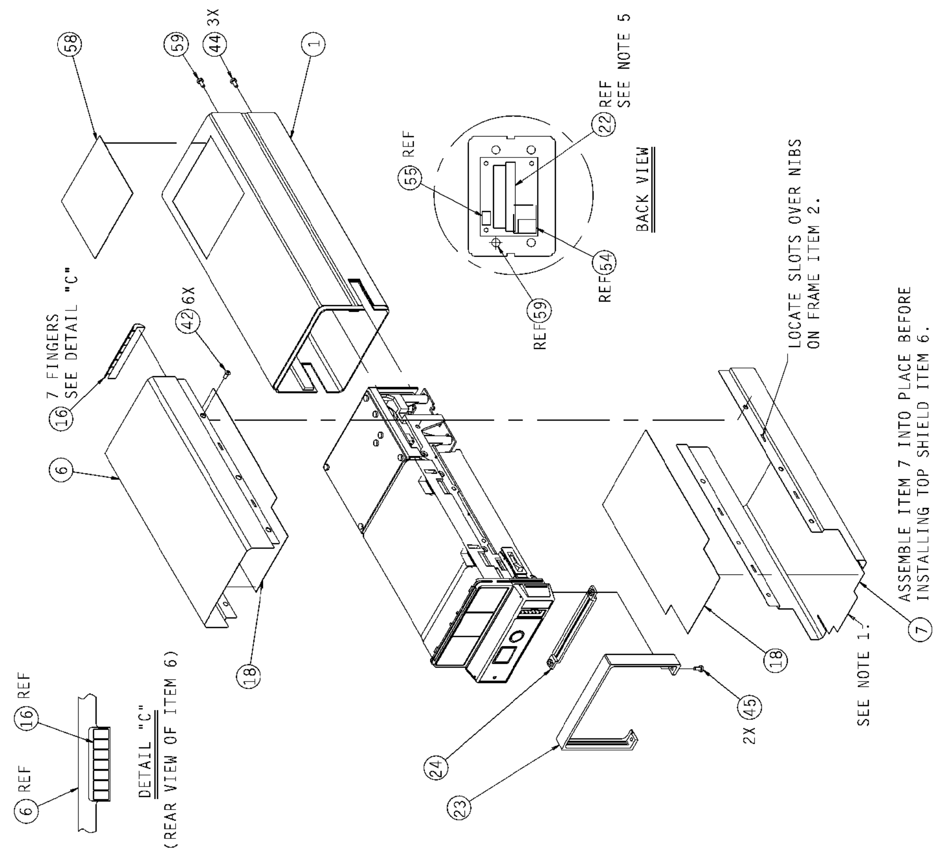
ASSEMBLED DETAIL

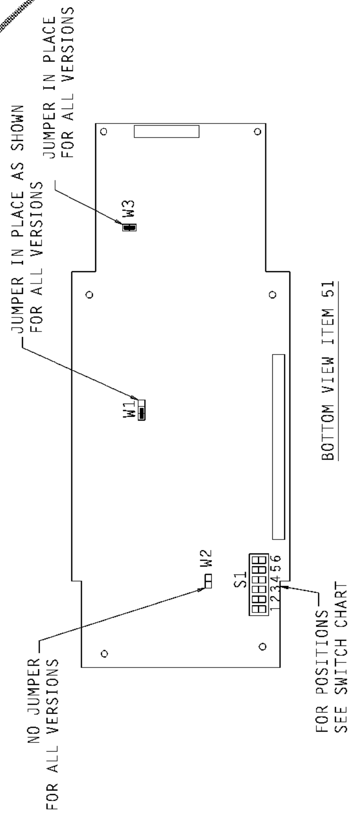
NOTE: HEAD OF TIE WRAP ITEM 49 MUST NOT BREAK EITHER OF THESE PLANES AFTER ASSEMBLY.

**2 of 2**


PRESSURE TRANSDUCER
CHECK VALVE
PUMP
IN-LINE FILTER
0.060 DIA. RESTRICTOR
PRESSURE TRANSDUCER
DAS ASSEMBLY
VALVE L2
MANIFOLD
VALVE L1
0.030 DIA. RESTRICTOR
DUAL TUBE PATIENT CUFF
DUAL TUBE HOSE
NBP PNEUMATIC CONNECTOR
PNEUMATIC SCHEMATIC


19
20
20
SHIPPING DETAIL
(SEE NOTES 3 AND 4)


58
59
44 3X
1
REF 22 SEE NOTE 5
55 REF
REF 54
REF 59
BACK VIEW
7 FINGERS SEE DETAIL "C"
16
42 6X
6
18
LOCATE SLOTS OVER NIBS ON FRAME ITEM 2.
ASSEMBLE ITEM 7 INTO PLACE BEFORE INSTALLING TOP SHIELD ITEM 6.
7
18
SEE NOTE 1.
2X 45
24
23
6 REF
16 REF
DETAIL "C"
(REAR VIEW OF ITEM 6)


JUMPER IN PLACE AS SHOWN FOR ALL VERSIONS
JUMPER IN PLACE FOR ALL VERSIONS
W3
W1
NO JUMPER FOR ALL VERSIONS
W2
S1
123456
FOR POSITIONS SEE SWITCH CHART
BOTTOM VIEW ITEM 51

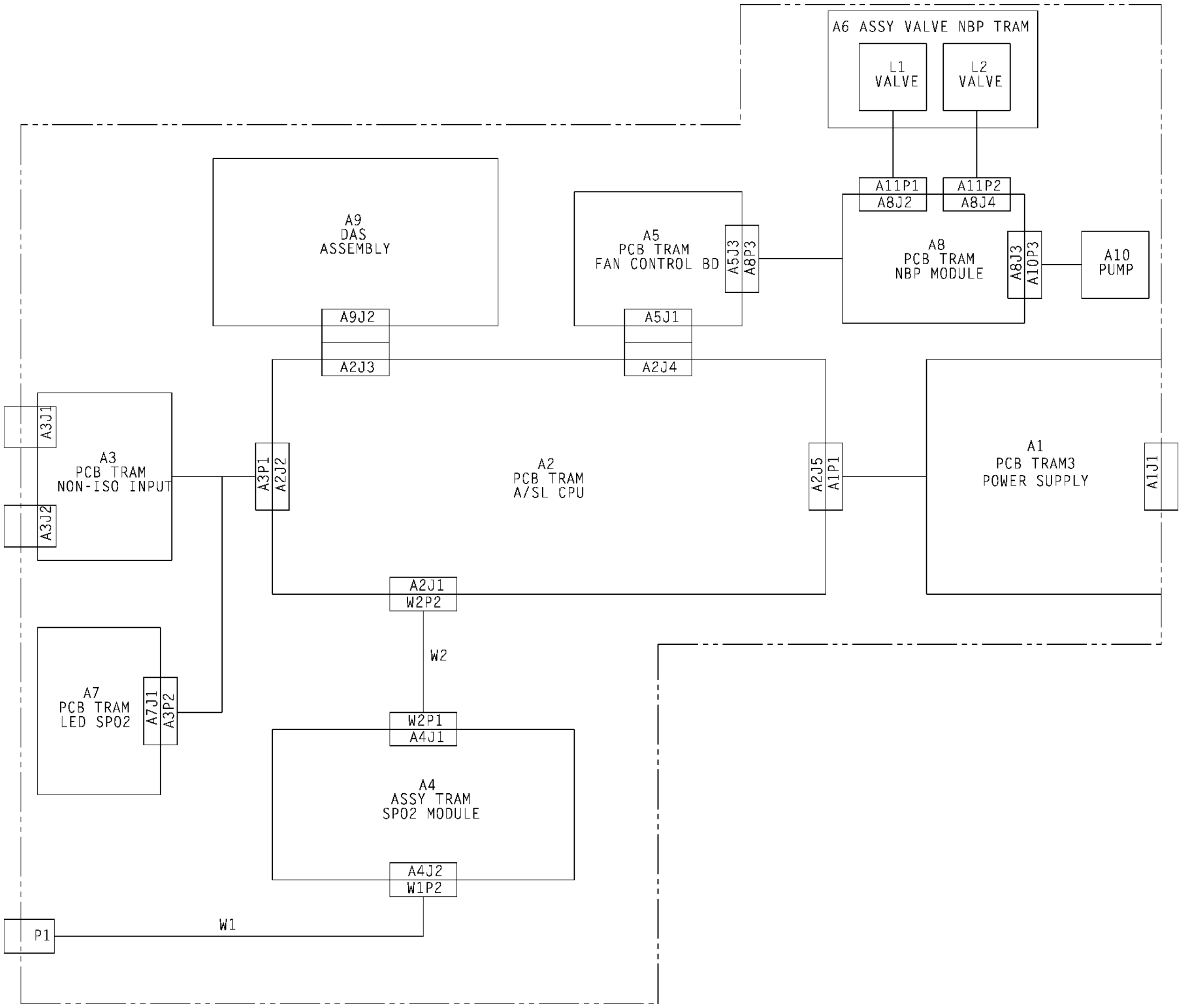
SWITCH CHART
(SEE NOTE 2)

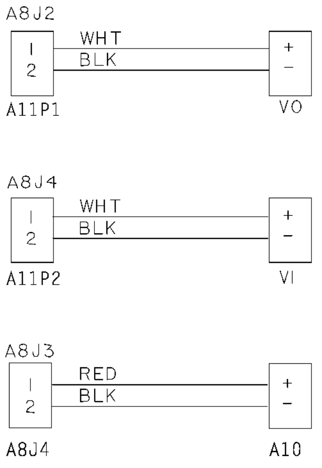
■□ =ON
□■ =OFF

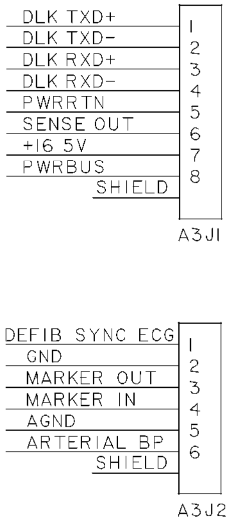
| DESCRIPTION | SW1 123456 | OMAR NUMBER |
|---|---|---|
| ENG 60HZ | □■ □■ □■ □■ □■ □■ | T250<br>T450<br>T850<br>T850SL =A,G |
| ENG 50HZ | □■ □■ □■ □■ □■ ■□ | T250<br>T450<br>T850<br>T850SL =A5 |
| SI 60HZ | □■ □■ □■ □■ ■□ □■ | T250<br>T450<br>T850<br>T850SL =Q |
| SI 50HZ | □■ □■ □■ □■ ■□ ■□ | T250<br>T450<br>T850<br>T850SL =S,H, T,J, P,W |

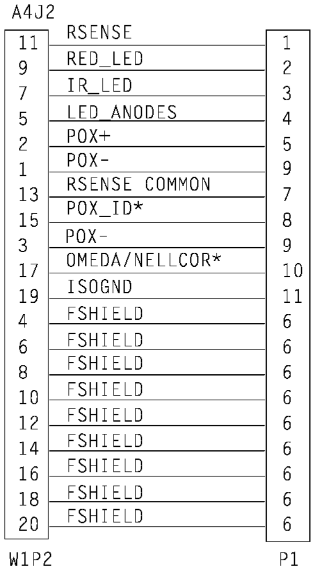
# Schematic Diagram PN 412651-001H

1 of 2


A6 ASSY VALVE NBP TRAM
L1 VALVE
L2 VALVE
A11P1
A8J2
A11P2
A8J4
A9 DAS ASSEMBLY
A9J2
A2J3
A5 PCB TRAM FAN CONTROL BD
A5J3
A8P3
A5J1
A2J4
A8 PCB TRAM NBP MODULE
A8J3
A10P3
A10 PUMP
A3J1
A3 PCB TRAM NON-ISO INPUT
A3J2
A3P1
A2J2
A2 PCB TRAM A/SL CPU
A2J5
A1P1
A1 PCB TRAM3 POWER SUPPLY
A1J1
A2J1
W2P2
W2
A7 PCB TRAM LED SPO2
A7J1
A3P2
W2P1
A4J1
A4 ASSY TRAM SPO2 MODULE
A4J2
W1P2
P1
W1


A8J2
1
2
WHT
BLK
+
−
A11P1
VO
A8J4
1
2
WHT
BLK
+
−
A11P2
VI
A8J3
1
2
RED
BLK
+
−
A8J4
A10


DLK TXD+
DLK TXD−
DLK RXD+
DLK RXD−
PWRRTN
SENSE OUT
+16.5V
PWRBUS
SHIELD
1
2
3
4
5
6
7
8
A3J1
DEFIB SYNC ECG
GND
MARKER OUT
MARKER IN
AGND
ARTERIAL BP
SHIELD
1
2
3
4
5
6
A3J2


A4J2
11 RSENSE 1
9 RED_LED 2
7 IR_LED 3
5 LED_ANODES 4
2 POX+ 5
1 POX− 9
13 RSENSE COMMON 7
15 POX_ID* 8
3 POX− 9
17 OMEDA/NELLCOR* 10
19 ISOGND 11
4 FSHIELD 6
6 FSHIELD 6
8 FSHIELD 6
10 FSHIELD 6
12 FSHIELD 6
14 FSHIELD 6
16 FSHIELD 6
18 FSHIELD 6
20 FSHIELD 6
W1P2
P1

**2 of 2**

| Signal | A1J1 |
|---|---|
| AGND | A1 |
| XMIT EN* | A2 |
| SYNC ECG RTN | A3 |
| SYNC ECG(10MV/V) | A4 |
| MOD DATA CLK* | A5 |
| MOD ATA IN | A6 |
| MOD DATA OUT | A7 |
| MOD DATA LCH* | A8 |
| BP3 | A9 |
| NC | A10 |
| GND | A11 |
| BKPLANE ID | A12 |
| NC | A13 |
| NC | A14 |
| AGND | A15 |
| ART BP | B1 |
| MOD ENABLE | B2 |
| BP2 | B3 |
| +16 5V | B4 |
| PWRBU | B5 |
| TRC2/ECGI | B6 |
| TRC1/ECGII | B7 |
| RESP/ECGV | B8 |
| NC | B9 |
| BP4 | B10 |
| GND | B11 |
| +5V | B12 |
| NC | B13 |
| NC | B14 |
| AGND | B15 |

| A2J4 | Signal | A5J1 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRRTN | 2 |
| 3 | PWRBUS | 3 |
| 4 | PWRRTN | 4 |
| 5 | NIBP P7 | 5 |
| 6 | SPARE | 6 |
| 7 | NIBP P6 | 7 |
| 8 | +5V | 8 |
| 9 | NIBP P5 | 9 |
| 10 | GND | 10 |
| 11 | NIBP P4 | 11 |
| 12 | FAN ENBL* | 12 |
| 13 | NIBP P3 | 13 |
| 14 | NIBP ENBL* | 14 |
| 15 | NIBP P2 | 15 |
| 16 | NIBP IO* | 16 |
| 17 | NIBP P1 | 17 |
| 18 | NIBP RD* | 18 |
| 19 | NIBP P0 | 19 |
| 20 | NIBP WR* | 20 |
| 21 | NIBP SEL0 | 21 |
| 22 | NIBP SEL1 | 22 |

| A2J5 | Signal | A1J2 |
|---|---|---|
| 1 | ART BP | 1 |
| 2 | SYNC ECG RTN | 2 |
| 3 | BP2 | 3 |
| 4 | SYNC ECG(10MV/V) | 4 |
| 5 | BP3 | 5 |
| 6 | BP4 | 6 |
| 7 | TRC2/ECGI | 7 |
| 8 | TRC1/ECGII | 8 |
| 9 | RESP/ECGV | 9 |
| 10 | SPARE | 10 |
| 11 | SPARE | 11 |
| 12 | AGND | 12 |
| 13 | -12 8 ANALOG | 13 |
| 14 | AGND | 14 |
| 15 | +12 8 ANALOG | 15 |
| 16 | +5 0 ANALOG | 16 |
| 17 | 5 0 RTN | 17 |
| 18 | -5 0 ANALOG | 18 |
| 19 | 5 0 RTN | 19 |
| 20 | XMIT EN* | 20 |
| 21 | MOD ENABLE | 21 |
| 22 | MOD DATA CLK* | 22 |
| 23 | MOD DATA IN | 23 |
| 24 | GND | 24 |
| 25 | MOD DATA OUT | 25 |
| 26 | GND | 26 |
| 27 | MOD DATA LCH* | 27 |
| 28 | BKPLANE ID | 28 |
| 29 | +5V | 29 |
| 30 | +5V BOOT | 30 |
| 31 | +5V | 31 |
| 32 | SPARE | 32 |
| 33 | +15 5V | 33 |
| 34 | PWRRTN | 34 |
| 35 | PWRRTN | 35 |
| 36 | +16 5V | 36 |
| 37 | +16 5V | 37 |
| 38 | SPARE | 38 |
| 39 | PWRBUS | 39 |
| 40 | PWRBUS | 40 |

A1P1

| A9J2 | Signal | A2J3 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRBUS | 2 |
| 3 | PWRRTN | 3 |
| 4 | PWRRTN | 4 |
| 5 | SPARE | 5 |
| 6 | SPARE | 6 |
| 7 | GND | 7 |
| 8 | DAS GTXD | 8 |
| 9 | GND | 9 |
| 10 | DAS GRXD | 10 |
| 11 | +5V | 11 |
| 12 | DAS GDEN* | 12 |
| 13 | +5V | 13 |
| 14 | DAS ENBL* | 14 |

| A3J3 | Signal | A2J2 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRBUS | 2 |
| 3 | +16 5V | 3 |
| 4 | +16 5V | 4 |
| 5 | PWRRTN | 5 |
| 6 | PWRRTN | 6 |
| 7 | DLK RXD+ | 7 |
| 8 | DLK RXD- | 8 |
| 9 | DLK TXD+ | 9 |
| 10 | DLK TXD- | 10 |
| 11 | DSYNC OUT | 11 |
| 12 | GND | 12 |
| 13 | MARKER RTN | 13 |
| 14 | GND | 14 |
| 15 | SPARE | 15 |
| 16 | SPARE | 16 |
| 17 | DSYNC ECG | 17 |
| 18 | AGND | 18 |
| 19 | BUF ART BP | 19 |
| 20 | AGND | 20 |

W2P2

| A7J1 | Signal | A2J2 |
|---|---|---|
| 1 | PWR LED | 21 |
| 2 | SPARE | 22 |
| 3 | SPARE | 23 |
| 4 | GND | 24 |

A3P1 W2P1

| A5J3 | Signal | A8P3 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRRTN | 2 |
| 3 | PWRBUS | 3 |
| 4 | PWRRTN | 4 |
| 5 | NIBP P7 | 5 |
| 6 | SPARE | 6 |
| 7 | NIBP P6 | 7 |
| 8 | +12V SW | 8 |
| 9 | NIBP P5 | 9 |
| 10 | +12V SW | 10 |
| 11 | NIBP P4 | 11 |
| 12 | SPARE | 12 |
| 13 | NIBP P3 | 13 |
| 14 | NIBP ENBL* | 14 |
| 15 | NIBP P2 | 15 |
| 16 | NIBP IO* | 16 |
| 17 | NIBP P1 | 17 |
| 18 | NIBP RD* | 18 |
| 19 | NIBP P0 | 19 |
| 20 | NIBP WR* | 20 |
| 21 | NIBP SEL0 | 21 |
| 22 | NIBP SEL1 | 22 |
| 23 | GND | 23 |
| 24 | +5V | 24 |

| A4J1 | Signal | A2J1 |
|---|---|---|
| 1 | NC | 1 |
| 2 | NC | 2 |
| 3 | NC | 3 |
| 4 | GND | 4 |
| 5 | NC | 5 |
| 6 | GND | 6 |
| 7 | NC | 7 |
| 8 | GND | 8 |
| 9 | NC | 9 |
| 10 | NC | 10 |
| 11 | NC | 11 |
| 12 | GND | 12 |
| 13 | NC | 13 |
| 14 | NC | 14 |
| 15 | NC | 15 |
| 16 | NC | 16 |
| 17 | NC | 17 |
| 18 | NC | 18 |
| 19 | NC | 19 |
| 20 | NC | 20 |
| 21 | NC | 21 |
| 22 | GND | 22 |
| 23 | NC | 23 |
| 24 | GND | 24 |
| 25 | NC | 25 |
| 26 | GND | 26 |
| 27 | OPER/TEST* | 27 |
| 28 | PA7 | 28 |
| 29 | SLOW/FAST* | 29 |
| 30 | PA6 | 30 |
| 31 | GND | 31 |
| 32 | PA5 | 32 |
| 33 | GND | 33 |
| 34 | PA4 | 34 |
| 35 | PAR/LCD* | 35 |
| 36 | PA3 | 36 |
| 37 | GND | 37 |
| 38 | PA2 | 38 |
| 39 | GND | 39 |
| 40 | PA1 | 40 |
| 41 | MINX RESET* | 41 |
| 42 | PA0 | 42 |
| 43 | PULSE | 43 |
| 44 | OBF* | 44 |
| 45 | INT DET | 45 |
| 46 | ACK* | 46 |
| 47 | CALIB OK | 47 |
| 48 | IBF | 48 |
| 49 | SPARE | 49 |
| 50 | STB* | 50 |
| 51 | LQS | 51 |
| 52 | NC | 52 |
| 53 | NO PRB | 53 |
| 54 | RXD* | 54 |
| 55 | PRB OFF | 55 |
| 56 | NC | 56 |
| 57 | LO SAT | 57 |
| 58 | +5 0 ANALOG | 58 |
| 59 | 5 0 RTN | 59 |
| 60 | -5 0 ANALOG | 60 |
| 61 | +5V | 61 |
| 62 | +5V | 62 |
| 63 | GND | 63 |
| 64 | GND | 64 |

W2P1 W2P2

# Parts List PN 412651-001H

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 1 | | Cover, Module | 400895-001 | 1 |
| 2 | | Frame | 400982-001 | 1 |
| 3 | A1 | Power Supply PCB | 401309-002 | 1 |
| 4 | A3 | Non-Isolated Input PCB | 401315-002 | 1 |
| 5 | | Tubing, Silastic | 401582-001 | AR |
| 6 | | Shield, Top | 401679-001 | 1 |
| 7 | | Shield, Bottom | 401679-002 | 1 |
| 8 | | Latch | 401682-001 | 2 |
| 9 | | Button, Latch | 402106-001 | 2 |
| 10 | | Screw, Shoulder | 402214-001 | 4 |
| 11 | | Spring, Compression | 402315-001 | 2 |
| 12 | | Plate, Chassis Ground, Bottom/Front | 402317-001 | 1 |
| 13 | | Pin, Latch | 402806-001 | 2 |
| 14 | A7 | Power Indicator PCB | 403170-011 | 1 |
| 15 | A5 | Fan PCB | 403549-002 | 1 |
| 16 | | Spring, Chassis Ground, Rear | 403741-001 | AR |
| 17 | | Screw, BDGH, Phillips, 4-40 x 7/8 | 404069-001 | 2 |
| 18 | | Insulator, Bottom Shield | 404188-001 | 2 |
| 19 | | Carton, Shipping | 404211-003 | 1 |
| 20 | | Foam, Insert | 404211-004 | |
| 21 | | Bracket, NBP Mounting | 404296-001 | 1 |
| 22 | | Label, Blank | 404525-006 | 1 |
| 23 | | Trim, Rubber, Front Bezel | 404620-001 | 1 |
| 24 | | Mounting Strap, Trim | 404621-001 | 1 |
| 25 | | Check Valve, 0.125 ID | 404675-001 | 1 |
| 26 | | Filter, 43 Micron | 404679-001 | 1 |
| 27 | | Plate, Chassis Ground, Rear | 404680-002 | 1 |
| 28 | | Grommet, 1/4 Dia, 1/8 High, 1/16 Panel Thickness | 404749-001 | 5 |
| 30 | | Spring, Latch | 406019-001 | 2 |
| 31 | | Pin, Latch | 406037-001 | 2 |
| 32 | | Bracket, Power Supply PCB | 406254-001 | 1 |
| 33 | W2 | Connector, Header, Dual, 64-Pin | 407452-002 | 1 |
| 34 | A10 | Pump Assembly, NBP, w/Harness | 408169-002 | 1 |
| 35 | A9 | 200 Acquisition Module, 10-Lead | 417120-001 | 1 |
| 36 | | Front Bezel, Tram | 412659-001 | 1 |
| 37 | A6 | NBP Valve Assembly | 416153-001 | 1 |
| 38 | | Label, Pulse Oximetry, Nellcor | 413831-002 | 1 |
| 39 | A4 | Pulse Oximetry Assembly (Including Pulse Oximetry PCB, PN 800674-00X) | 414409-001 | 1 |
| 40 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 4502-406 | 2 |
| 41 | | Screw, BDGH, Phillips, 4-40 x 1-1/4 | 4502-440 | 4 |

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 42 | | Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16 | 4505-406 | 6 |
| 43 | | Screw, FLH, Phillips, SST, 4-40 x 3/8 | 4505-412 | 2 |
| 44 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 45074-406 | 15 |
| 45 | | Screw, BDGH, Phillips, 4-40 x 3/8 | 45074-412 | 2 |
| 46 | | Screw, BDGH, Phillips, 4-40 x 5/8 | 45074-420 | 2 |
| 47 | | Screw, BDGH, Phillips, 4-40 x 3/4 | 45074-424 | 4 |
| 48 | | Nut, Hex, 4-40 | 4521-304 | 2 |
| 49 | | Tie Wrap | 4535-002 | 1 |
| 50 | | Adhesive, Diecut, Front Right | 415098-003 | 1 |
| 51 | A2 | Module Processor PCB | 800210-005 | 1 |
| 52 | A8 | NPB PCB | 800316-002 | 1 |
| 53 | W1 | Harness, Pulse Oximetry PCB-to-Connector | 800892-001 | 1 |
| 54 | | Label, UL Listed | 408230-002 | 1 |
| 55 | | Label, 60 Hertz | 411091-018 | 1 |
| 55 | | Label, 50 Hertz | 411091-019 | 1 |
| 56 | | Label, Top, English (Determined by Destination) | 411173-009 | 1 |
| 56 | | Label, Top, German (Determined by Destination) | 411173-010 | 1 |
| 56 | | Label, Top, French (Determined by Destination) | 411173-011 | 1 |
| 56 | | Label, Top, Swedish (Determined by Destination) | 411173-012 | 1 |
| 56 | | Label, Top, Spanish (Determined by Destination) | 411173-013 | 1 |
| 56 | | Label, Top, Italian (Determined by Destination) | 411173-014 | 1 |
| 57 | | Label, Front, 250SL, English (Determined by Destination) | 413835-001 | 1 |
| 57 | | Label, Front, 250SL, German (Determined by Destination) | 413835-002 | 1 |
| 57 | | Label, Front, 250SL, French (Determined by Destination) | 413835-003 | 1 |
| 57 | | Label, Front, 250SL, Swedish (Determined by Destination) | 413835-004 | 1 |
| 57 | | Label, Front, 250SL, Spanish (Determined by Destination) | 413835-005 | 1 |
| 57 | | Label, Front, 250SL, Italian (Determined by Destination) | 413835-006 | 1 |
| 57 | | Label, Front, 250SL, Dutch (Determined by Destination) | 413835-007 | 1 |
| 58 | | Label, Cover, English (Determined by Destination) | 414045-001 | 1 |
| 58 | | Label, Cover, German (Determined by Destination) | 414045-002 | 1 |
| 58 | | Label, Cover, French (Determined by Destination) | 414045-003 | 1 |
| 58 | | Label, Cover, Swedish (Determined by Destination) | 414045-004 | 1 |
| 58 | | Label, Cover, Spanish (Determined by Destination) | 414045-005 | 1 |
| 58 | | Label, Cover, Italian (Determined by Destination) | 414045-006 | 1 |
| 58 | | Label, Cover, International (Determined by Destination) | 414045-007 | 1 |
| 59 | | Spring, Chassis Ground, Small | 414610-001 | AR |
| 59 | | Screw, PHD, 4-40 x 0.188, Modified (Determined by Destination) | 409009-001 | 1 |

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 59 | | Screw, PHD, 4-40 x 0.188 (Determined by Destination) | 45074-406 | 1 |
| 60 | | Adhesive, Diecut, Front Left | 415098-002 | 1 |
| 61 | | Tram 100 - 850 A and SL Module Service Manual | 404422-065 | 1 |
| 62 | | Label, CE Mark | 408230-008 | 1 |
| 63 | | PC Post, 2 x 7 | 412062-004 | 1 |
| 64 | | PC Post, 2 x 11 | 412062-005 | 1 |

# Assembly Revisions PN 412651

The baseline revision for this assembly is pn 412651-001H. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

## PN 412651-001A

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 35 | A9 | DAS 200 Module, 10-Lead | 411166-001 | 417120-001 | 1 |
| 37 | A6 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 51 |  | Module Processor PCB | 800210-002 | 800210-005 | 1 |
| 52 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |
| 59 |  | Spring, Chassis Ground, Small | Not Used | 414610-001 | AR |
| 60 |  | Adhesive, Front Diecut, Left | Not Used | 415098-002 | 1 |
| 62 |  | Label, CE Mark | Not Used | 408230-008 | 1 |
| 63 |  | PC Post, 2 x 7 | Not Used | 412062-004 | 1 |
| 64 |  | PC Post, 2 x 11 | Not Used | 412062-005 | 1 |

## PN 412651-001B

This revision was a documentation change that does not affect this manual.
Refer to pn 412651-001A for changes to the parts list.

## PN 412651-001C

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 35 | A9 | DAS 200 Module, 10-Lead | 411166-001 | 417120-001 | 1 |
| 37 | A6 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 51 |  | Module Processor PCB | 800210-002 | 800210-005 | 1 |
| 52 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |
| 62 |  | Label, CE Mark | Not Used | 408230-008 | 1 |
| 63 |  | PC Post, 2 x 7 | Not Used | 412062-004 | 1 |
| 64 |  | PC Post, 2 x 11 | Not Used | 412062-005 | 1 |

## PN 412651-001D

This revision was a documentation change that does not affect this manual.
Refer to pn 412651-001C for changes to the parts list.

## PN 412651-001E

This revision was a documentation change that does not affect this manual.
Refer to pn 412651-001C for changes to the parts list.

## PN 412651-001F

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 35 | A9 | DAS 200 Module, 10-Lead | 411166-001 | 417120-001 | 1 |
| 37 | A6 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 52 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |

## PN 412651-001G

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 35 | A9 | DAS 200 Module, 10-Lead | 411166-001 | 417120-001 | 1 |
| 52 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |

*For your notes*

# 10 TRAM 400A/SL MODULE PN 410496/411161

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# General

## Circuit Boards

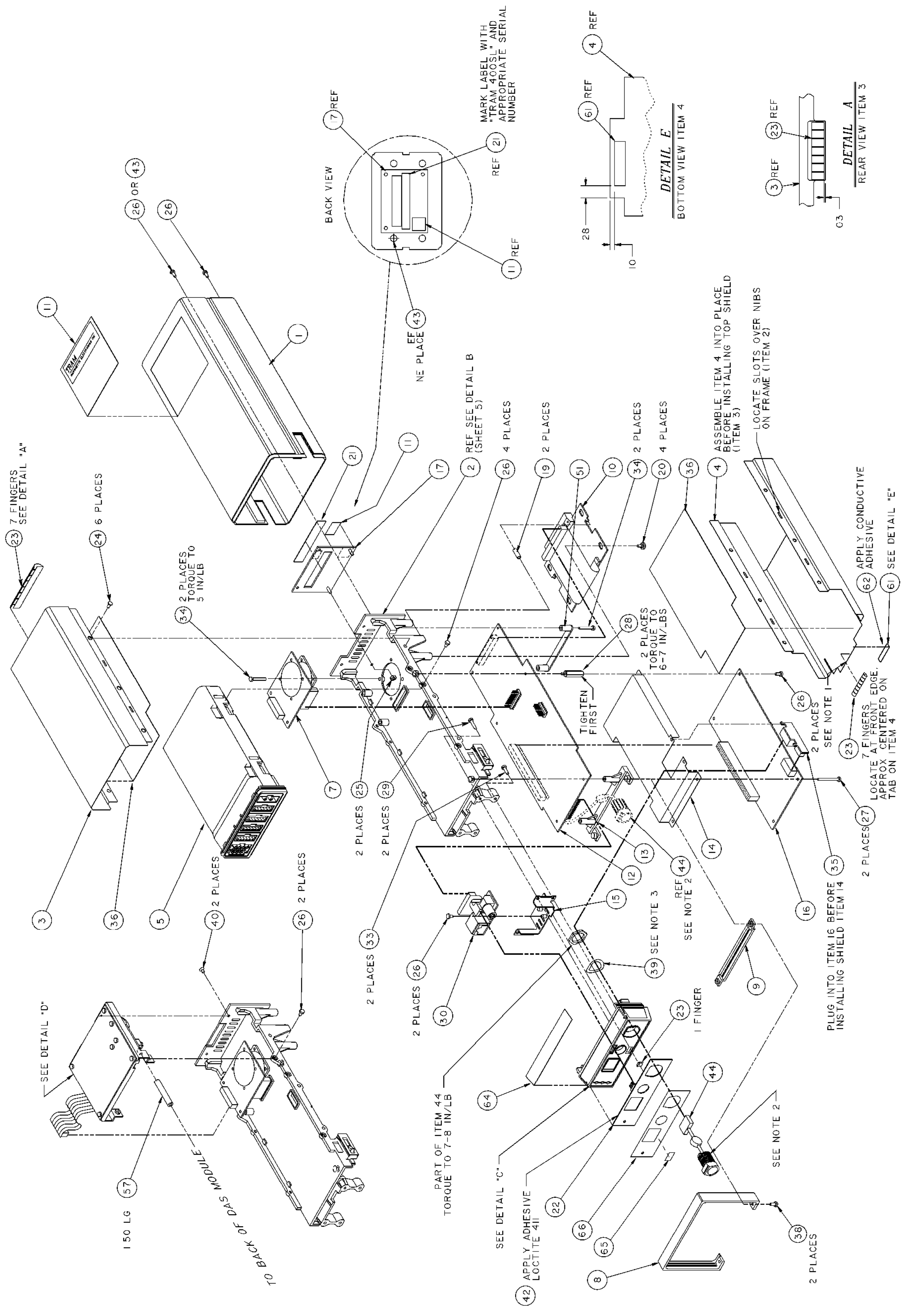
Details about the circuit boards contained in the Tram 400A/SL are discussed in later chapters arranged by part number.

**Table 8-1. Circuit Board Overview**

| Module Type | Upper Level | Leadwire Configuration | DAS Module | Acquisition Processor PCB | Module Processor PCB |
|---|---|---|---|---|---|
| Tram 400A | 410496-001A–C | 5-Leadwire | 410495-001 | 800330-009 | 800210-005 |
| Tram 400SL | 411161-001A–H | 10-Leadwire | 411167-001 | 800330-010 | 800210-005 |
| Tram 400SL | 411161-001J | 10-Leadwire | 417121-001<br>(Replaced 411167-001) | 801040-001 | 800210-005 |

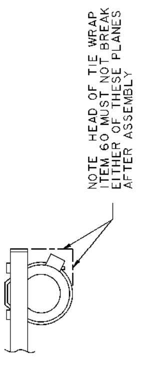
# Exploded View PN 410496-001D

1 of 2

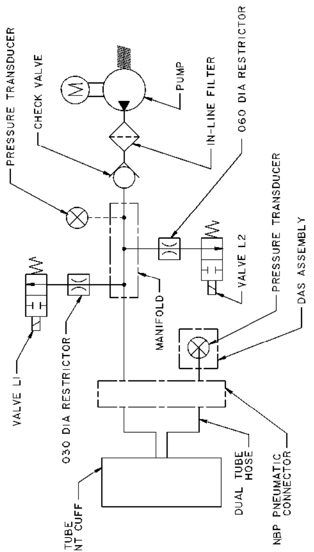

MARK LABEL WITH "TRAM 400SL" AND APPROPRIATE SERIAL NUMBER
7 REF
BACK VIEW
21 REF
11 REF
43
EF
NE PLACE
4 REF
61 REF
DETAIL E
BOTTOM VIEW ITEM 4
28
10
23 REF
3 REF
DETAIL A
REAR VIEW ITEM 3
.03
26 OR 43
26
11
1
23 7 FINGERS SEE DETAIL "A"
24 6 PLACES
34 2 PLACES TORQUE TO 5 IN/LB
21
11
17
2 REF SEE DETAIL B (SHEET 5)
26 4 PLACES
19 2 PLACES
51
10
34 2 PLACES
20 4 PLACES
36
4 ASSEMBLE ITEM 4 INTO PLACE BEFORE INSTALLING TOP SHIELD (ITEM 3)
LOCATE SLOTS OVER NIBS ON FRAME (ITEM 2)
28 2 PLACES TORQUE TO 6-7 IN/LBS
TIGHTEN FIRST
62 APPLY CONDUCTIVE ADHESIVE
61 SEE DETAIL "E"
26
2 PLACES SEE NOTE 1
23 7 FINGERS LOCATE AT FRONT EDGE, APPROX CENTERED ON TAB ON ITEM 4
27 2 PLACES
35
16
14
44 REF SEE NOTE 2
13
12
15
SEE NOTE 3
39
9
PLUG INTO ITEM 16 BEFORE INSTALLING SHIELD ITEM 14
7
25 2 PLACES
29 2 PLACES
3
36
5
40 2 PLACES
26 2 PLACES
33 2 PLACES
26 2 PLACES
30 2 PLACES
23 1 FINGER
44
SEE NOTE 2
38 2 PLACES
8
65
66
22
42 APPLY ADHESIVE LOCTITE 411
SEE DETAIL "C"
PART OF ITEM 44 TORQUE TO 7-8 IN/LB
64
SEE DETAIL "D"
57
1.50 LG
TO BACK OF DAS MODULE

**2 of 2**

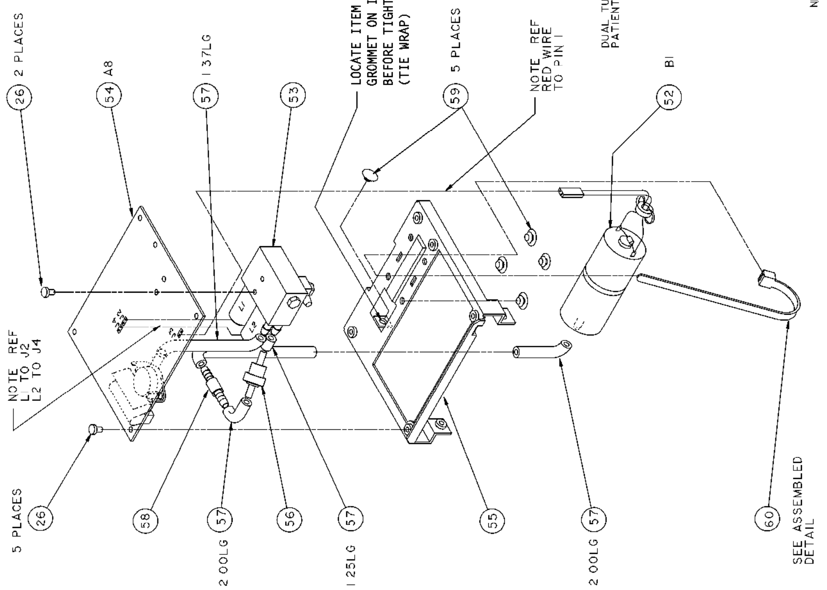
| LEAD IDENT | ITEM NO | FROM | TO |
|---|---|---|---|
| W6 | 52 | B1P1 | A8J3 |
| W4 | 53 | W4P2 | A8J2 |
| W5 | 53 | B1P3 | A8J4 |


NOTE HEAD OF TIE WRAP ITEM 60 MUST NOT BREAK EITHER OF THESE PLANES AFTER ASSEMBLY

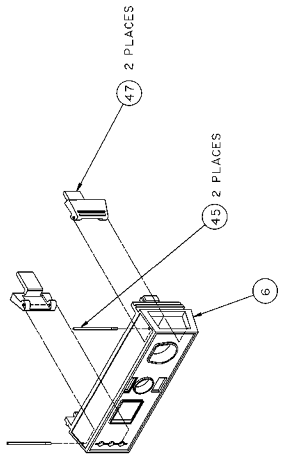
ASSEMBLED DETAIL


PRESSURE TRANSDUCER
CHECK VALVE
M
PUMP
IN-LINE FILTER
060 DIA RESTRICTOR
PRESSURE TRANSDUCER
DAS ASSEMBLY
VALVE L2
MANIFOLD
VALVE L1
030 DIA RESTRICTOR
DUAL TUBE PATIENT CUFF
DUAL TUBE HOSE
NBP PNEUMATIC CONNECTOR

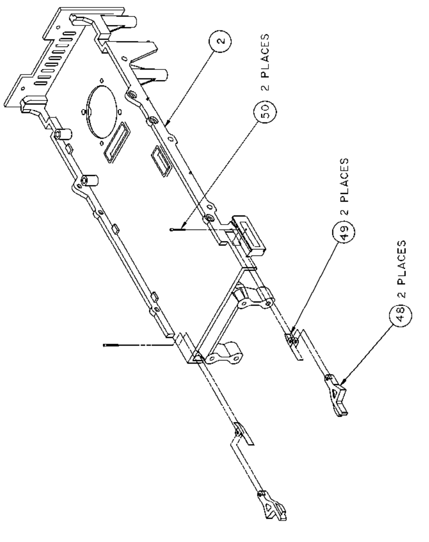
PNEUMATIC SCHEMATIC


26
2 PLACES
54
A8
57
1 37LG
53
LOCATE ITEM 56 9PUMP) AGAINST GROMMET ON ITEM 59 9BRACKET) BEFORE TIGHTENING ITEM 64 (TIE WRAP)
59
5 PLACES
NOTE REF RED WIRE TO PIN 1
52
B1
NOTE REF L1 TO J2 L2 TO J4
L1
26
5 PLACES
58
57
2 00LG
56
57
1 25LG
55
57
2 00LG
60
SEE ASSEMBLED DETAIL

DETAIL D


47
2 PLACES
45
2 PLACES
6

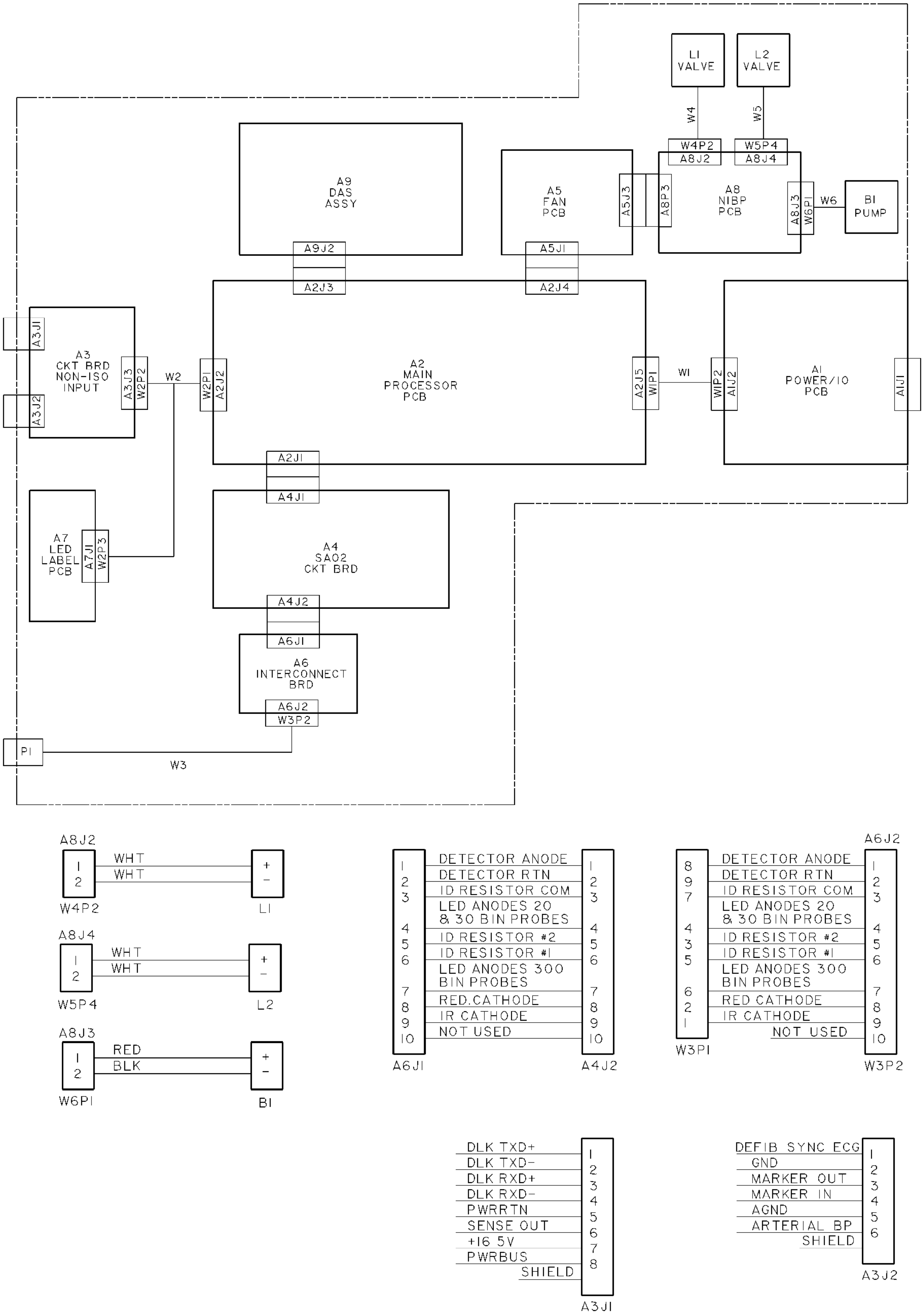
DETAIL C


2
50
2 PLACES
49
2 PLACES
48
2 PLACES

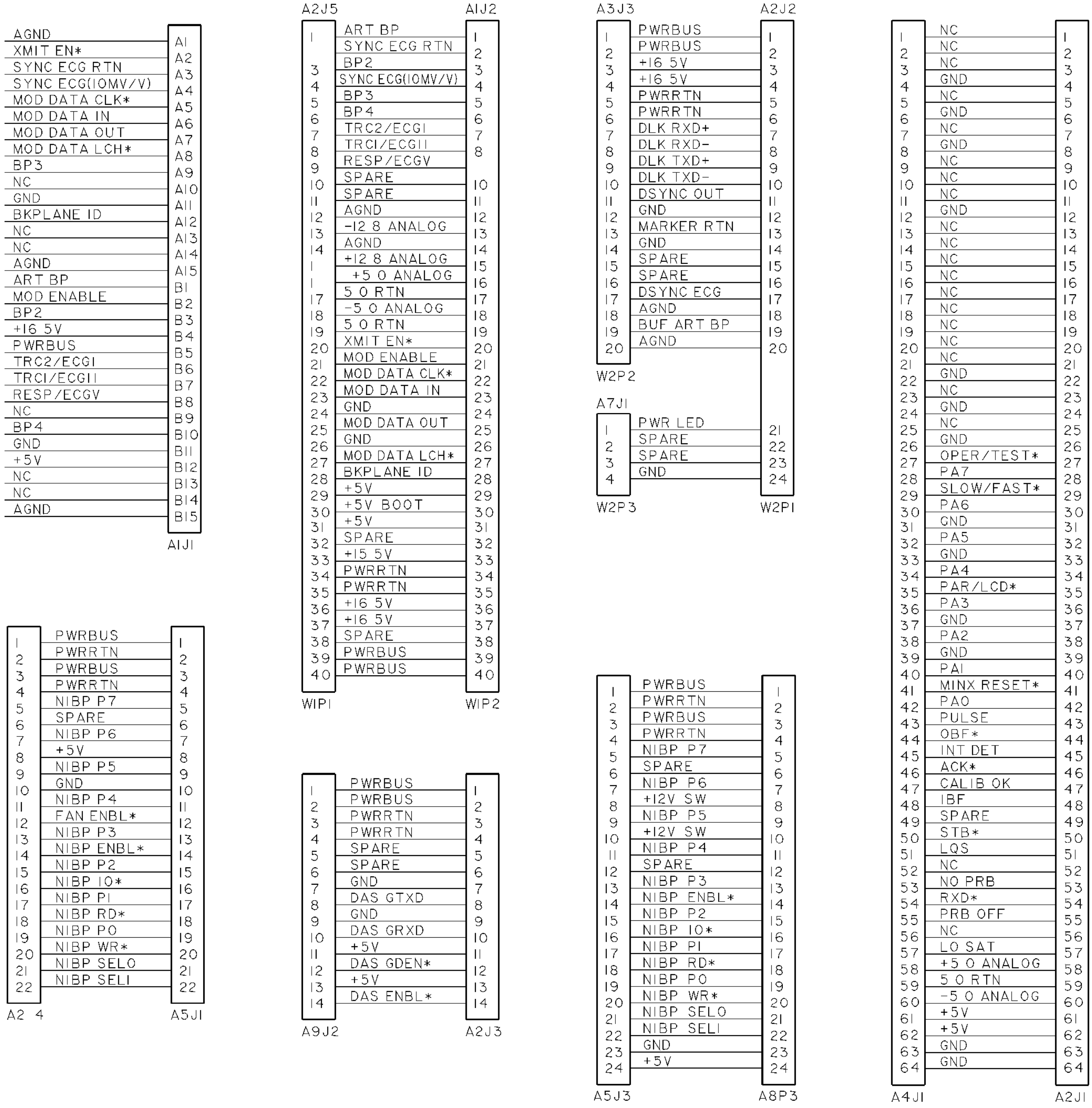
DETAIL B

# Schematic Diagram PN 410496-001D

1 of 2


L1 VALVE
L2 VALVE
W4
W5
W4P2
A8J2
W5P4
A8J4
A9 DAS ASSY
A9J2
A2J3
A5 FAN PCB
A5J3
A8P3
A5J1
A2J4
A8 NIBP PCB
A8J3
W6P1
W6
B1 PUMP
A3J1
A3 CKT BRD NON-ISO INPUT
A3J3
W2P2
W2
W2P1
A2J2
A2 MAIN PROCESSOR PCB
A2J5
W1P1
W1
W1P2
A1J2
A1 POWER/IO PCB
A1J1
A3J2
A2J1
A4J1
A7 LED LABEL PCB
A7J1
W2P3
A4 SA02 CKT BRD
A4J2
A6J1
A6 INTERCONNECT BRD
A6J2
W3P2
P1
W3
A8J2
1
2
WHT
WHT
+
−
W4P2
L1
A8J4
1
2
WHT
WHT
+
−
W5P4
L2
A8J3
1
2
RED
BLK
+
−
W6P1
B1
1 DETECTOR ANODE 1
2 DETECTOR RTN 2
3 ID RESISTOR COM 3
LED ANODES 20 & 30 BIN PROBES
4 ID RESISTOR #2 4
5 ID RESISTOR #1 5
6 LED ANODES 300 BIN PROBES 6
7 RED.CATHODE 7
8 IR CATHODE 8
9 9
10 NOT USED 10
A6J1
A4J2
A6J2
8 DETECTOR ANODE 1
9 DETECTOR RTN 2
7 ID RESISTOR COM 3
LED ANODES 20 & 30 BIN PROBES
4 ID RESISTOR #2 4
3 ID RESISTOR #1 5
5 LED ANODES 300 BIN PROBES 6
6 RED CATHODE 7
2 IR CATHODE 8
1 9
NOT USED 10
W3P1
W3P2
DLK TXD+ 1
DLK TXD− 2
DLK RXD+ 3
DLK RXD− 4
PWRRTN 5
SENSE OUT 6
+16 5V 7
PWRBUS 8
SHIELD
A3J1
DEFIB SYNC ECG 1
GND 2
MARKER OUT 3
MARKER IN 4
AGND 5
ARTERIAL BP 6
SHIELD
A3J2

**2 of 2**



| | A1J1 |
|---|---|
| AGND | A1 |
| XMIT EN* | A2 |
| SYNC ECG RTN | A3 |
| SYNC ECG(10MV/V) | A4 |
| MOD DATA CLK* | A5 |
| MOD DATA IN | A6 |
| MOD DATA OUT | A7 |
| MOD DATA LCH* | A8 |
| BP3 | A9 |
| NC | A10 |
| GND | A11 |
| BKPLANE ID | A12 |
| NC | A13 |
| NC | A14 |
| AGND | A15 |
| ART BP | B1 |
| MOD ENABLE | B2 |
| BP2 | B3 |
| +16 5V | B4 |
| PWRBUS | B5 |
| TRC2/ECGI | B6 |
| TRC1/ECGII | B7 |
| RESP/ECGV | B8 |
| NC | B9 |
| BP4 | B10 |
| GND | B11 |
| +5V | B12 |
| NC | B13 |
| NC | B14 |
| AGND | B15 |

| A2J5 / W1P1 | | A1J2 / W1P2 |
|---|---|---|
| 1 | ART BP | 1 |
| | SYNC ECG RTN | 2 |
| 3 | BP2 | 3 |
| 4 | SYNC ECG(10MV/V) | 4 |
| 5 | BP3 | 5 |
| 6 | BP4 | 6 |
| 7 | TRC2/ECGI | 7 |
| 8 | TRC1/ECGII | 8 |
| 9 | RESP/ECGV | |
| 10 | SPARE | 10 |
| 11 | SPARE | 11 |
| 12 | AGND | 12 |
| 13 | -12 8 ANALOG | 13 |
| 14 | AGND | 14 |
| 1 | +12 8 ANALOG | 15 |
| 1 | +5 0 ANALOG | 16 |
| 17 | 5 0 RTN | 17 |
| 18 | -5 0 ANALOG | 18 |
| 19 | 5 0 RTN | 19 |
| 20 | XMIT EN* | 20 |
| 21 | MOD ENABLE | 21 |
| 22 | MOD DATA CLK* | 22 |
| 23 | MOD DATA IN | 23 |
| 24 | GND | 24 |
| 25 | MOD DATA OUT | 25 |
| 26 | GND | 26 |
| 27 | MOD DATA LCH* | 27 |
| 28 | BKPLANE ID | 28 |
| 29 | +5V | 29 |
| 30 | +5V BOOT | 30 |
| 31 | +5V | 31 |
| 32 | SPARE | 32 |
| 33 | +15 5V | 33 |
| 34 | PWRRTN | 34 |
| 35 | PWRRTN | 35 |
| 36 | +16 5V | 36 |
| 37 | +16 5V | 37 |
| 38 | SPARE | 38 |
| 39 | PWRBUS | 39 |
| 40 | PWRBUS | 40 |

| A3J3 / W2P2 | | A2J2 / W2P1 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRBUS | 2 |
| 3 | +16 5V | 3 |
| 4 | +16 5V | 4 |
| 5 | PWRRTN | 5 |
| 6 | PWRRTN | 6 |
| 7 | DLK RXD+ | 7 |
| 8 | DLK RXD- | 8 |
| 9 | DLK TXD+ | 9 |
| 10 | DLK TXD- | 10 |
| 11 | DSYNC OUT | 11 |
| 12 | GND | 12 |
| 13 | MARKER RTN | 13 |
| 14 | GND | 14 |
| 15 | SPARE | 15 |
| 16 | SPARE | 16 |
| 17 | DSYNC ECG | 17 |
| 18 | AGND | 18 |
| 19 | BUF ART BP | 19 |
| 20 | AGND | 20 |

| A7J1 / W2P3 | | A2J2 / W2P1 |
|---|---|---|
| 1 | PWR LED | 21 |
| 2 | SPARE | 22 |
| 3 | SPARE | 23 |
| 4 | GND | 24 |

| A4J1 | | A2J1 |
|---|---|---|
| 1 | NC | 1 |
| 2 | NC | 2 |
| 3 | NC | 3 |
| 4 | GND | 4 |
| 5 | NC | 5 |
| 6 | GND | 6 |
| 7 | NC | 7 |
| 8 | GND | 8 |
| 9 | NC | 9 |
| 10 | NC | 10 |
| 11 | NC | 11 |
| 12 | GND | 12 |
| 13 | NC | 13 |
| 14 | NC | 14 |
| 15 | NC | 15 |
| 16 | NC | 16 |
| 17 | NC | 17 |
| 18 | NC | 18 |
| 19 | NC | 19 |
| 20 | NC | 20 |
| 21 | NC | 21 |
| 22 | GND | 22 |
| 23 | NC | 23 |
| 24 | GND | 24 |
| 25 | NC | 25 |
| 26 | GND | 26 |
| 27 | OPER/TEST* | 27 |
| 28 | PA7 | 28 |
| 29 | SLOW/FAST* | 29 |
| 30 | PA6 | 30 |
| 31 | GND | 31 |
| 32 | PA5 | 32 |
| 33 | GND | 33 |
| 34 | PA4 | 34 |
| 35 | PAR/LCD* | 35 |
| 36 | PA3 | 36 |
| 37 | GND | 37 |
| 38 | PA2 | 38 |
| 39 | GND | 39 |
| 40 | PA1 | 40 |
| 41 | MINX RESET* | 41 |
| 42 | PA0 | 42 |
| 43 | PULSE | 43 |
| 44 | OBF* | 44 |
| 45 | INT DET | 45 |
| 46 | ACK* | 46 |
| 47 | CALIB OK | 47 |
| 48 | IBF | 48 |
| 49 | SPARE | 49 |
| 50 | STB* | 50 |
| 51 | LQS | 51 |
| 52 | NC | 52 |
| 53 | NO PRB | 53 |
| 54 | RXD* | 54 |
| 55 | PRB OFF | 55 |
| 56 | NC | 56 |
| 57 | LO SAT | 57 |
| 58 | +5 0 ANALOG | 58 |
| 59 | 5 0 RTN | 59 |
| 60 | -5 0 ANALOG | 60 |
| 61 | +5V | 61 |
| 62 | +5V | 62 |
| 63 | GND | 63 |
| 64 | GND | 64 |

| A2 4 | | A5J1 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRRTN | 2 |
| 3 | PWRBUS | 3 |
| 4 | PWRRTN | 4 |
| 5 | NIBP P7 | 5 |
| 6 | SPARE | 6 |
| 7 | NIBP P6 | 7 |
| 8 | +5V | 8 |
| 9 | NIBP P5 | 9 |
| 10 | GND | 10 |
| 11 | NIBP P4 | 11 |
| 12 | FAN ENBL* | 12 |
| 13 | NIBP P3 | 13 |
| 14 | NIBP ENBL* | 14 |
| 15 | NIBP P2 | 15 |
| 16 | NIBP IO* | 16 |
| 17 | NIBP P1 | 17 |
| 18 | NIBP RD* | 18 |
| 19 | NIBP P0 | 19 |
| 20 | NIBP WR* | 20 |
| 21 | NIBP SEL0 | 21 |
| 22 | NIBP SEL1 | 22 |

| A9J2 | | A2J3 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRBUS | 2 |
| 3 | PWRRTN | 3 |
| 4 | PWRRTN | 4 |
| 5 | SPARE | 5 |
| 6 | SPARE | 6 |
| 7 | GND | 7 |
| 8 | DAS GTXD | 8 |
| 9 | GND | 9 |
| 10 | DAS GRXD | 10 |
| 11 | +5V | 11 |
| 12 | DAS GDEN* | 12 |
| 13 | +5V | 13 |
| 14 | DAS ENBL* | 14 |

| A5J3 | | A8P3 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRRTN | 2 |
| 3 | PWRBUS | 3 |
| 4 | PWRRTN | 4 |
| 5 | NIBP P7 | 5 |
| 6 | SPARE | 6 |
| 7 | NIBP P6 | 7 |
| 8 | +12V SW | 8 |
| 9 | NIBP P5 | 9 |
| 10 | +12V SW | 10 |
| 11 | NIBP P4 | 11 |
| 12 | SPARE | 12 |
| 13 | NIBP P3 | 13 |
| 14 | NIBP ENBL* | 14 |
| 15 | NIBP P2 | 15 |
| 16 | NIBP IO* | 16 |
| 17 | NIBP P1 | 17 |
| 18 | NIBP RD* | 18 |
| 19 | NIBP P0 | 19 |
| 20 | NIBP WR* | 20 |
| 21 | NIBP SEL0 | 21 |
| 22 | NIBP SEL1 | 22 |
| 23 | GND | 23 |
| 24 | +5V | 24 |

# Parts List PN 410496-001D

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 1 | | Cover, Module | 400895-001 | 1 |
| 2 | | Frame | 400982-001 | 1 |
| 3 | | Shield, Top | 401679-001 | 1 |
| 4 | | Shield, Bottom | 401679-002 | 1 |
| 5 | | 400 Acquisition Module, 5-Lead | 410495-001 | 1 |
| 6 | | Front Bezel, Lower | 401105-004 | 1 |
| 7 | A5 | Fan PCB | 403549-002 | 1 |
| 8 | | Trim, Rubber, Front Bezel | 404620-001 | 1 |
| 9 | | Mounting Strap, Trim | 404621-001 | 1 |
| 10 | A1, W1 | Power Supply PCB | 401309-002 | 1 |
| 11 | | Label, Isolated Connector Function, Tram 400A, English | 410540-001 | 1 |
| 12 | A2 | Module Processor PCB | 800210-001 | 1 |
| 13 | | Circuit Board/Bezel Mount | 404762-001 | 1 |
| 14 | | Shield, Pulse Oximetry PCB | 401680-001 | 1 |
| 15 | | Plate, Chassis Ground, Bottom/Front | 402317-001 | 1 |
| 16 | A4 | Pulse Oximetry PCB | 401189-001 | 1 |
| 17 | | Plate, Chassis Ground, Rear | 404680-002 | 1 |
| 19 | | Spring, Compression | 402315-001 | 2 |
| 20 | | Screw, Power Supply PCB Mounting, SST, 4-40 | 402214-001 | 4 |
| 21 | | Label, Model/Serial Number | 404525-006 | 1 |
| 22 | | Power Indicator PCB | 403170-008 | 1 |
| 23 | | Spring, Chassis Ground, Rear | 403741-001 | AR |
| 24 | | Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16 | 4505-406 | 6 |
| 25 | | Nut, Hex, 4-40 | 4521-304 | 2 |
| 26 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 45074-406 | 19 |
| 27 | | Screw, BDGH, Phillips, 4-40 x 1-3/8 | 45074-438 | 2 |
| 28 | | Spacer, Male/Female, 4-40 x 0.875 | 4656-414 | 2 |
| 29 | | Screw, 4-40 x 7/8 | 404069-001 | 2 |
| 30 | A3, W2 | Non-Isolated Input PCB | 401315-002 | 1 |
| 31 | | Carton, Shipping | 404211-003 | 1 |
| 32 | | Foam Insert | 404211-004 | 2 |
| 33 | | Screw, BDGH, Phillips, 4-40 x 5/8 | 45074-420 | 2 |
| 34 | | Screw, BDGH, Phillips, 4-40 x 3/4 | 45074-424 | 4 |
| 35 | A6 | Interconnect PCB | 800006-001 | 1 |
| 36 | | Insulator, Bottom Shield | 404188-001 | 2 |
| 38 | | Screw, BDGH, Phillips, 4-40 x 3/8 | 45074-412 | 2 |
| 39 | | Washer, Pulse Oximetry Connector | 4550-250 | 1 |
| 40 | | Screw, FLH, Phillips, SST, 4-40 x 3/8 | 4505-412 | 2 |
| 41 | | Tram 100 - 850 A & SL Modules Service Manual | 404422-065 | – |
| 42 | | Adhesive, Loctite Prism 411 | 4851-082 | AR |

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 43 | | Screw, PNHD, 4-40 x 0.188 | 409009-001 | 1 |
| 44 | W3 | Harness, Pulse Oximetry PCB-to-Connector | 700091-004 | 1 |
| 45 | | Pin, Latch | 402806-001 | 2 |
| 46 | | Spring, Flat, SST | 405041-001 | 2 |
| 47 | | Button, Latch | 402106-001 | 2 |
| 48 | | Latch | 401682-001 | 2 |
| 49 | | Spring, Latch | 406019-001 | 2 |
| 50 | | Pin, Latch | 406037-001 | 2 |
| 51 | | Bracket, Power Supply PCB | 406254-001 | 1 |
| 52 | B1, W6 | Pump Assembly, NBP, w/Harness | 408169-002 | 1 |
| 53 | V1, V2, W4, W5 | NBP Valve Assembly | 404459-001 | 1 |
| 54 | A8 | NBP PCB | 800316-001 | 1 |
| 55 | | Bracket, NBP Mounting | 404296-001 | 1 |
| 56 | | Check Valve, 0.125 ID | 404675-001 | 1 |
| 57 | | Tubing, Silastic | 401582-001 | AR |
| 58 | | Filter, 43 Micron | 404679-001 | 1 |
| 59 | | Grommet, 1/4 Dia, 1/8 High, 1/16 Panel Thickness | 404749-001 | 5 |
| 60 | | Tie Wrap | 4535-002 | 1 |
| 61 | | Gasket, Silver-Nickel | 407894-001 | 1 |
| 62 | | Adhesive, Conductive | 4851-088 | AR |
| 65 | | Label, Leadwire Warning | 414097-001 | 1 |
| – | | Label, LED, English (Determined by Destination) | 410540-002 | 1 |
| 66 | | Label, Top, English (Determined by Destination) | 410540-009 | 1 |
| – | | Label, Cover, English (Determined by Destination) | 410540-016 | 1 |
| – | | Label, 60 Hertz (Determined by Destination) | 410540-018 | 1 |
| – | | Label, 50 Hertz (Determined by Destination) | 410540-019 | 1 |

# Assembly Revisions PN 410496

The baseline revision for this assembly is pn 410496-001D. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

## PN 410496-001A

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 44 | | Pulse Oximetry PCB Harness | 700091-001 | 700091-004 | 1 |

## PN 410496-001B

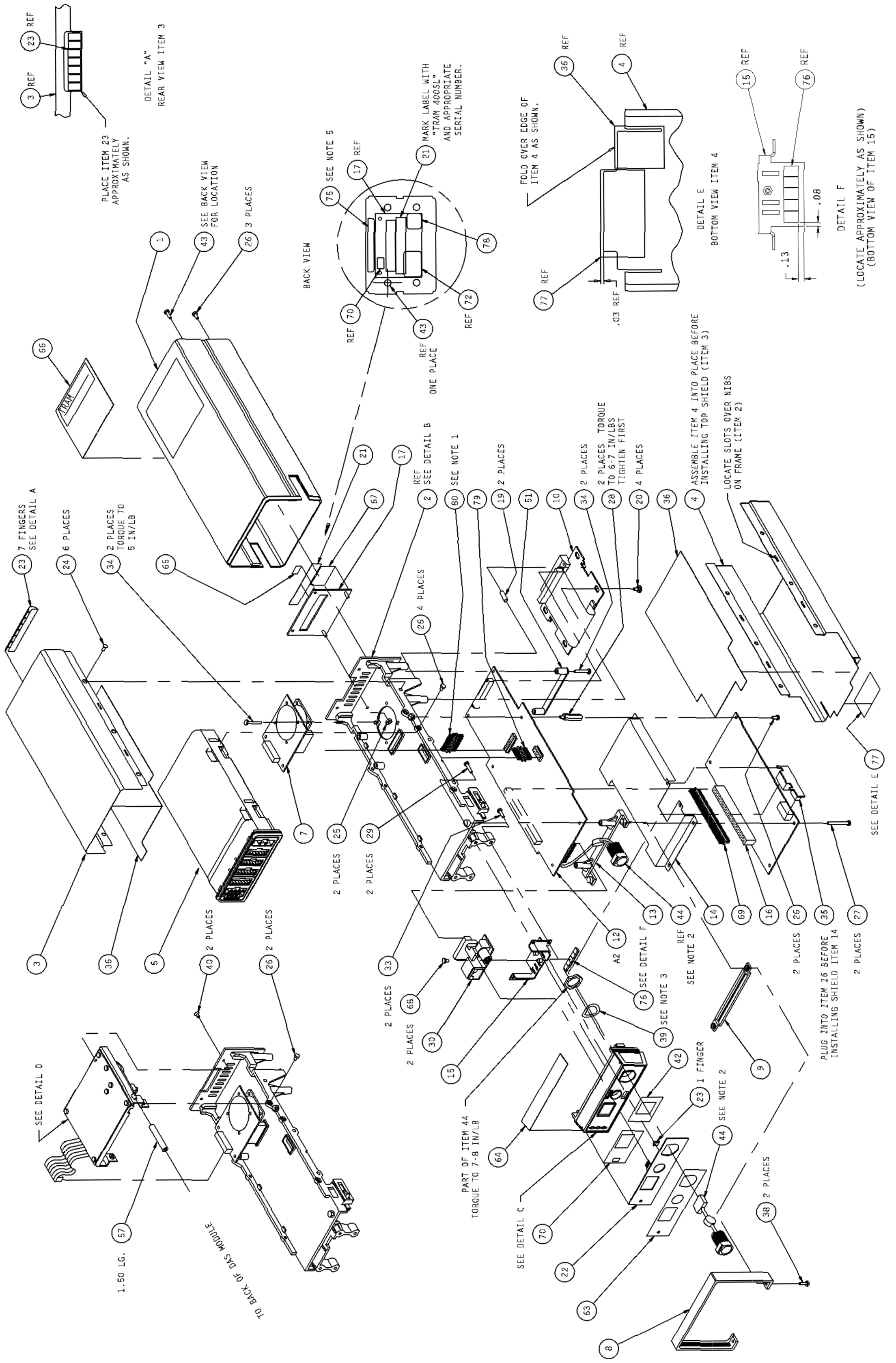
This revision was a documentation change that does not affect this manual.
Refer to pn 410496-001A for changes to the parts list.

## PN 410496-001C

This revision was a documentation change that does not affect this manual.
Refer to pn 410496-001A for changes to the parts list.

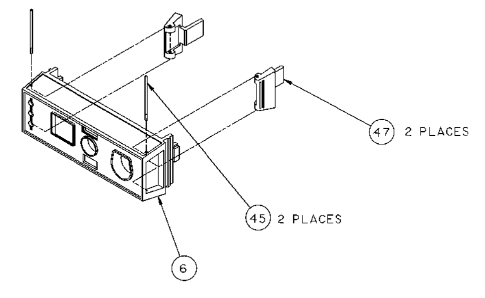
# Exploded View PN 411161-001J

1 of 2

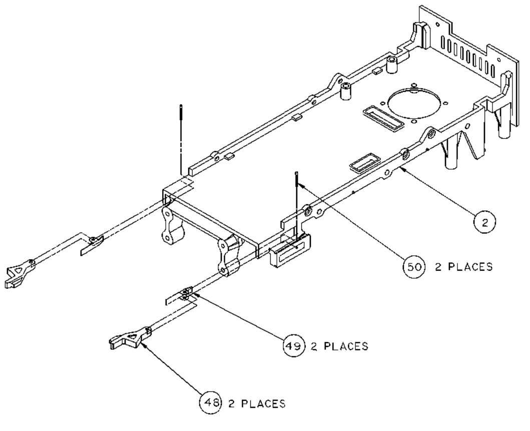

3 REF
23 REF
PLACE ITEM 23 APPROXIMATELY AS SHOWN.
DETAIL "A" REAR VIEW ITEM 3
1
43 SEE BACK VIEW FOR LOCATION
26 3 PLACES
BACK VIEW
75 SEE NOTE 5
17 REF
21 MARK LABEL WITH "TRAM 400SL" AND APPROPRIATE SERIAL NUMBER.
78
72 REF
43 REF ONE PLACE
70 REF
36 REF
4 REF
FOLD OVER EDGE OF ITEM 4 AS SHOWN.
DETAIL E BOTTOM VIEW ITEM 4
77 REF
.03 REF
15 REF
76 REF
.08
.13
DETAIL F (LOCATE APPROXIMATELY AS SHOWN) (BOTTOM VIEW OF ITEM 15)
66
TRAM
65
23 7 FINGERS SEE DETAIL A
24 6 PLACES
34 2 PLACES TORQUE TO 5 IN/LB
21
67
17
2 REF SEE DETAIL B
80 SEE NOTE 1
79
19 2 PLACES
51
10
34 2 PLACES
28 2 PLACES TORQUE TO 6-7 IN/LBS TIGHTEN FIRST
20 4 PLACES
36
4 ASSEMBLE ITEM 4 INTO PLACE BEFORE INSTALLING TOP SHIELD (ITEM 3)
LOCATE SLOTS OVER NIBS ON FRAME (ITEM 2)
26 4 PLACES
77 SEE DETAIL E
3
36
5
7
25 2 PLACES
29 2 PLACES
40 2 PLACES
26 2 PLACES
33
A2 12
13 SEE DETAIL F
44 REF SEE NOTE 2
14
69
16
26 2 PLACES
35 PLUG INTO ITEM 16 BEFORE INSTALLING SHIELD ITEM 14
27 2 PLACES
68 2 PLACES
30 2 PLACES
76 SEE NOTE 3
39 SEE NOTE 3
15
9
42
23 1 FINGER
44 SEE NOTE 2
64
PART OF ITEM 44 TORQUE TO 7-8 IN/LB
70
SEE DETAIL C
22
63
38 2 PLACES
8
SEE DETAIL D
57
1.50 LG.
TO BACK OF DAS MODULE

**2 of 2**

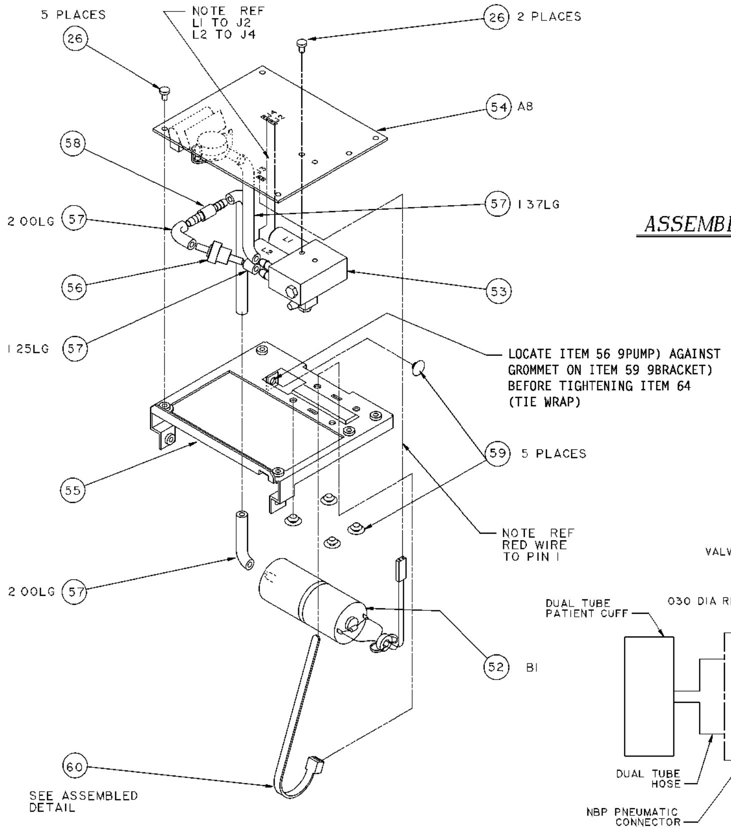
| LEAD IDENT | ITEM NO | FROM | TO |
|---|---|---|---|
| W6 | 52 | B1P1 | A8J3 |
| W4 | 53 | W4P2 | A8J2 |
| W5 | 53 | B1P3 | A8J4 |


47 2 PLACES
45 2 PLACES
6

DETAIL C

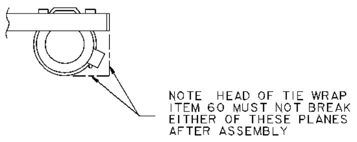

2
50 2 PLACES
49 2 PLACES
48 2 PLACES

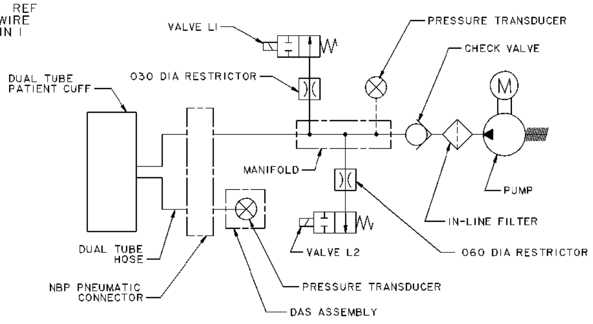
DETAIL B


5 PLACES 26
NOTE REF L1 TO J2 L2 TO J4
26 2 PLACES
54 A8
58
2 00LG 57
57 1 37LG
56
53
1 25LG 57
LOCATE ITEM 56 9PUMP) AGAINST GROMMET ON ITEM 59 9BRACKET) BEFORE TIGHTENING ITEM 64 (TIE WRAP)
59 5 PLACES
55
NOTE REF RED WIRE TO PIN 1
2 00LG 57
52 B1
60
SEE ASSEMBLED DETAIL

DETAIL D

ASSEMBLED DETAIL

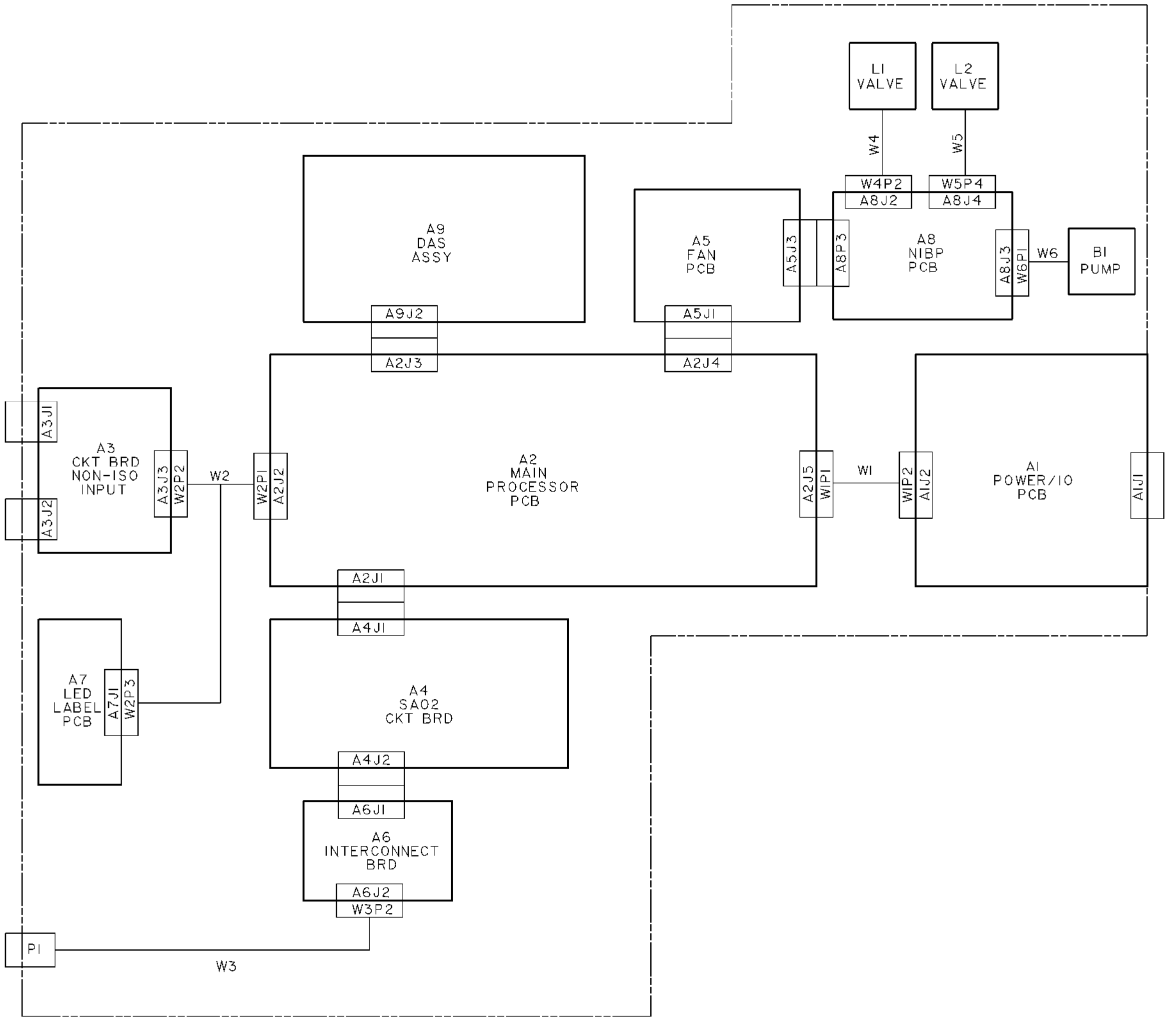

NOTE HEAD OF TIE WRAP ITEM 60 MUST NOT BREAK EITHER OF THESE PLANES AFTER ASSEMBLY

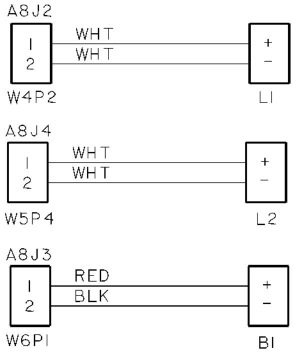

VALVE L1
030 DIA RESTRICTOR
DUAL TUBE PATIENT CUFF
PRESSURE TRANSDUCER
CHECK VALVE
M
MANIFOLD
PUMP
IN-LINE FILTER
VALVE L2
060 DIA RESTRICTOR
DUAL TUBE HOSE
NBP PNEUMATIC CONNECTOR
PRESSURE TRANSDUCER
DAS ASSEMBLY

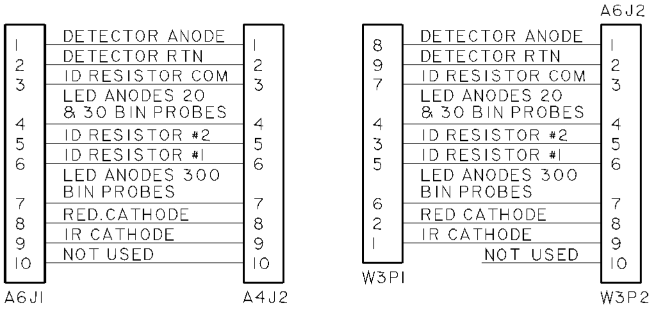
PNEUMATIC SCHEMATIC

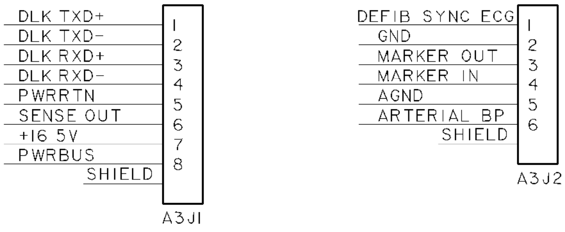
# Schematic Diagram PN 411161-001J

1 of 2

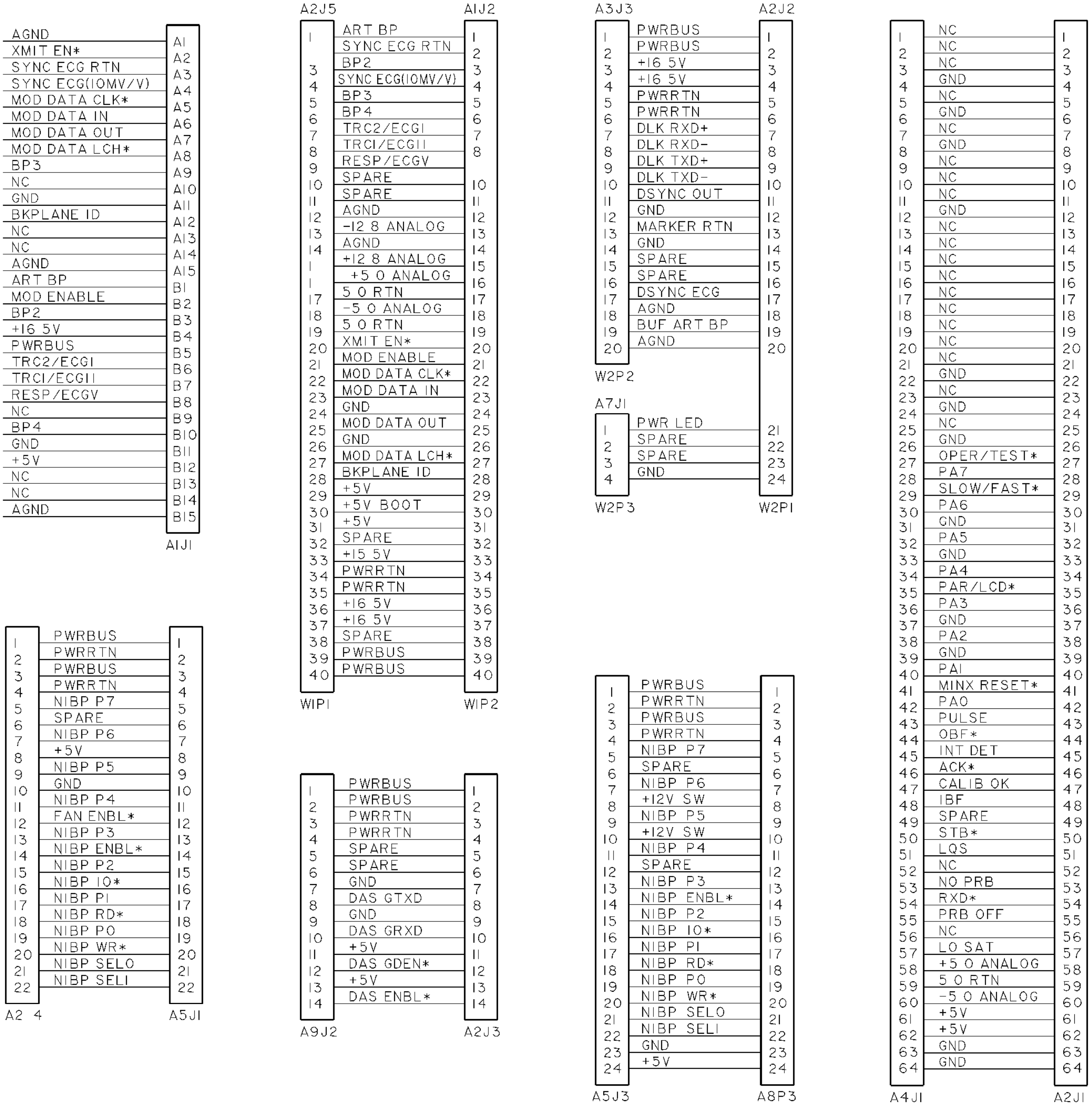

L1 VALVE
L2 VALVE
W4
W5
W4P2
A8J2
W5P4
A8J4
A9 DAS ASSY
A5 FAN PCB
A5J3
A8P3
A8 NIBP PCB
A8J3
W6P1
W6
B1 PUMP
A9J2
A2J3
A5J1
A2J4
A3J1
A3 CKT BRD NON-ISO INPUT
A3J3
W2P2
W2
W2P1
A2J2
A2 MAIN PROCESSOR PCB
A2J5
W1P1
W1
W1P2
A1J2
A1 POWER/IO PCB
A1J1
A3J2
A2J1
A4J1
A7 LED LABEL PCB
A7J1
W2P3
A4 SAO2 CKT BRD
A4J2
A6J1
A6 INTERCONNECT BRD
A6J2
W3P2
P1
W3


A8J2
1
2
WHT
WHT
+
−
W4P2
L1
A8J4
1
2
WHT
WHT
+
−
W5P4
L2
A8J3
1
2
RED
BLK
+
−
W6P1
B1


A6J1 1 2 3 4 5 6 7 8 9 10
DETECTOR ANODE
DETECTOR RTN
ID RESISTOR COM
LED ANODES 20 & 30 BIN PROBES
ID RESISTOR #2
ID RESISTOR #1
LED ANODES 300 BIN PROBES
RED.CATHODE
IR CATHODE
NOT USED
A4J2 1 2 3 4 5 6 7 8 9 10
W3P1 8 9 7 4 3 5 6 2 1
DETECTOR ANODE
DETECTOR RTN
ID RESISTOR COM
LED ANODES 20 & 30 BIN PROBES
ID RESISTOR #2
ID RESISTOR #1
LED ANODES 300 BIN PROBES
RED CATHODE
IR CATHODE
NOT USED
A6J2
W3P2 1 2 3 4 5 6 7 8 9 10


DLK TXD+ 1
DLK TXD− 2
DLK RXD+ 3
DLK RXD− 4
PWRRTN 5
SENSE OUT 6
+16.5V 7
PWRBUS 8
SHIELD
A3J1
DEFIB SYNC ECG 1
GND 2
MARKER OUT 3
MARKER IN 4
AGND 5
ARTERIAL BP 6
SHIELD
A3J2

**2 of 2**



| Signal | A1J1 |
|---|---|
| AGND | A1 |
| XMIT EN* | A2 |
| SYNC ECG RTN | A3 |
| SYNC ECG(10MV/V) | A4 |
| MOD DATA CLK* | A5 |
| MOD DATA IN | A6 |
| MOD DATA OUT | A7 |
| MOD DATA LCH* | A8 |
| BP3 | A9 |
| NC | A10 |
| GND | A11 |
| BKPLANE ID | A12 |
| NC | A13 |
| NC | A14 |
| AGND | A15 |
| ART BP | B1 |
| MOD ENABLE | B2 |
| BP2 | B3 |
| +16 5V | B4 |
| PWRBUS | B5 |
| TRC2/ECGI | B6 |
| TRC1/ECGII | B7 |
| RESP/ECGV | B8 |
| NC | B9 |
| BP4 | B10 |
| GND | B11 |
| +5V | B12 |
| NC | B13 |
| NC | B14 |
| AGND | B15 |
|  | A1J1 |

| A2J4 |  | A5J1 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRRTN | 2 |
| 3 | PWRBUS | 3 |
| 4 | PWRRTN | 4 |
| 5 | NIBP P7 | 5 |
| 6 | SPARE | 6 |
| 7 | NIBP P6 | 7 |
| 8 | +5V | 8 |
| 9 | NIBP P5 | 9 |
| 10 | GND | 10 |
| 11 | NIBP P4 | 11 |
| 12 | FAN ENBL* | 12 |
| 13 | NIBP P3 | 13 |
| 14 | NIBP ENBL* | 14 |
| 15 | NIBP P2 | 15 |
| 16 | NIBP IO* | 16 |
| 17 | NIBP P1 | 17 |
| 18 | NIBP RD* | 18 |
| 19 | NIBP P0 | 19 |
| 20 | NIBP WR* | 20 |
| 21 | NIBP SEL0 | 21 |
| 22 | NIBP SEL1 | 22 |
| A2 4 |  | A5J1 |

| A2J5 |  | A1J2 |
|---|---|---|
| 1 | ART BP | 1 |
|  | SYNC ECG RTN | 2 |
| 3 | BP2 | 3 |
| 4 | SYNC ECG(10MV/V) | 4 |
| 5 | BP3 | 5 |
| 6 | BP4 | 6 |
| 7 | TRC2/ECGI | 7 |
| 8 | TRC1/ECGII | 8 |
| 9 | RESP/ECGV |  |
| 10 | SPARE | 10 |
| 11 | SPARE | 11 |
| 12 | AGND | 12 |
| 13 | -12 8 ANALOG | 13 |
| 14 | AGND | 14 |
| 1 | +12 8 ANALOG | 15 |
| 1 | +5 0 ANALOG | 16 |
| 17 | 5 0 RTN | 17 |
| 18 | -5 0 ANALOG | 18 |
| 19 | 5 0 RTN | 19 |
| 20 | XMIT EN* | 20 |
| 21 | MOD ENABLE | 21 |
| 22 | MOD DATA CLK* | 22 |
| 23 | MOD DATA IN | 23 |
| 24 | GND | 24 |
| 25 | MOD DATA OUT | 25 |
| 26 | GND | 26 |
| 27 | MOD DATA LCH* | 27 |
| 28 | BKPLANE ID | 28 |
| 29 | +5V | 29 |
| 30 | +5V BOOT | 30 |
| 31 | +5V | 31 |
| 32 | SPARE | 32 |
| 33 | +15 5V | 33 |
| 34 | PWRRTN | 34 |
| 35 | PWRRTN | 35 |
| 36 | +16 5V | 36 |
| 37 | +16 5V | 37 |
| 38 | SPARE | 38 |
| 39 | PWRBUS | 39 |
| 40 | PWRBUS | 40 |
| W1P1 |  | W1P2 |

| A9J2 |  | A2J3 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRBUS | 2 |
| 3 | PWRRTN | 3 |
| 4 | PWRRTN | 4 |
| 5 | SPARE | 5 |
| 6 | SPARE | 6 |
| 7 | GND | 7 |
| 8 | DAS GTXD | 8 |
| 9 | GND | 9 |
| 10 | DAS GRXD | 10 |
| 11 | +5V | 11 |
| 12 | DAS GDEN* | 12 |
| 13 | +5V | 13 |
| 14 | DAS ENBL* | 14 |
| A9J2 |  | A2J3 |

| A3J3 |  | A2J2 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRBUS | 2 |
| 3 | +16 5V | 3 |
| 4 | +16 5V | 4 |
| 5 | PWRRTN | 5 |
| 6 | PWRRTN | 6 |
| 7 | DLK RXD+ | 7 |
| 8 | DLK RXD- | 8 |
| 9 | DLK TXD+ | 9 |
| 10 | DLK TXD- | 10 |
| 11 | DSYNC OUT | 11 |
| 12 | GND | 12 |
| 13 | MARKER RTN | 13 |
| 14 | GND | 14 |
| 15 | SPARE | 15 |
| 16 | SPARE | 16 |
| 17 | DSYNC ECG | 17 |
| 18 | AGND | 18 |
| 19 | BUF ART BP | 19 |
| 20 | AGND | 20 |
| W2P2 |  |  |
| A7J1 |  |  |
| 1 | PWR LED | 21 |
| 2 | SPARE | 22 |
| 3 | SPARE | 23 |
| 4 | GND | 24 |
| W2P3 |  | W2P1 |

| A5J3 |  | A8P3 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRRTN | 2 |
| 3 | PWRBUS | 3 |
| 4 | PWRRTN | 4 |
| 5 | NIBP P7 | 5 |
| 6 | SPARE | 6 |
| 7 | NIBP P6 | 7 |
| 8 | +12V SW | 8 |
| 9 | NIBP P5 | 9 |
| 10 | +12V SW | 10 |
| 11 | NIBP P4 | 11 |
| 12 | SPARE | 12 |
| 13 | NIBP P3 | 13 |
| 14 | NIBP ENBL* | 14 |
| 15 | NIBP P2 | 15 |
| 16 | NIBP IO* | 16 |
| 17 | NIBP P1 | 17 |
| 18 | NIBP RD* | 18 |
| 19 | NIBP P0 | 19 |
| 20 | NIBP WR* | 20 |
| 21 | NIBP SEL0 | 21 |
| 22 | NIBP SEL1 | 22 |
| 23 | GND | 23 |
| 24 | +5V | 24 |
| A5J3 |  | A8P3 |

| A4J1 |  | A2J1 |
|---|---|---|
| 1 | NC | 1 |
| 2 | NC | 2 |
| 3 | NC | 3 |
| 4 | GND | 4 |
| 5 | NC | 5 |
| 6 | GND | 6 |
| 7 | NC | 7 |
| 8 | GND | 8 |
| 9 | NC | 9 |
| 10 | NC | 10 |
| 11 | NC | 11 |
| 12 | GND | 12 |
| 13 | NC | 13 |
| 14 | NC | 14 |
| 15 | NC | 15 |
| 16 | NC | 16 |
| 17 | NC | 17 |
| 18 | NC | 18 |
| 19 | NC | 19 |
| 20 | NC | 20 |
| 21 | NC | 21 |
| 22 | GND | 22 |
| 23 | NC | 23 |
| 24 | GND | 24 |
| 25 | NC | 25 |
| 26 | GND | 26 |
| 27 | OPER/TEST* | 27 |
| 28 | PA7 | 28 |
| 29 | SLOW/FAST* | 29 |
| 30 | PA6 | 30 |
| 31 | GND | 31 |
| 32 | PA5 | 32 |
| 33 | GND | 33 |
| 34 | PA4 | 34 |
| 35 | PAR/LCD* | 35 |
| 36 | PA3 | 36 |
| 37 | GND | 37 |
| 38 | PA2 | 38 |
| 39 | GND | 39 |
| 40 | PA1 | 40 |
| 41 | MINX RESET* | 41 |
| 42 | PA0 | 42 |
| 43 | PULSE | 43 |
| 44 | OBF* | 44 |
| 45 | INT DET | 45 |
| 46 | ACK* | 46 |
| 47 | CALIB OK | 47 |
| 48 | IBF | 48 |
| 49 | SPARE | 49 |
| 50 | STB* | 50 |
| 51 | LQS | 51 |
| 52 | NC | 52 |
| 53 | NO PRB | 53 |
| 54 | RXD* | 54 |
| 55 | PRB OFF | 55 |
| 56 | NC | 56 |
| 57 | LO SAT | 57 |
| 58 | +5 0 ANALOG | 58 |
| 59 | 5 0 RTN | 59 |
| 60 | -5 0 ANALOG | 60 |
| 61 | +5V | 61 |
| 62 | +5V | 62 |
| 63 | GND | 63 |
| 64 | GND | 64 |
| A4J1 |  | A2J1 |

# Parts List PN 411161-001J

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 1 | | Cover, Module | 400895-001 | 1 |
| 2 | | Frame | 400982-001 | 1 |
| 3 | | Shield, Top | 401679-001 | 1 |
| 4 | | Shield, Bottom | 401679-002 | 1 |
| 5 | A9 | 400 Acquisition Module, 10-Lead | 417121-001 | 1 |
| 6 | | Front Bezel, Lower | 401105-004 | 1 |
| 7 | A5 | Fan PCB | 403549-002 | 1 |
| 8 | | Trim, Rubber, Front Bezel | 404620-001 | 1 |
| 9 | | Mounting Strap, Trim | 404621-001 | 1 |
| 10 | A1, W1 | Power Supply PCB | 401309-002 | 1 |
| 12 | A2 | Module Processor PCB | 800210-005 | 1 |
| 13 | | Circuit Board/Bezel Mount | 404762-001 | 1 |
| 14 | | Shield, Pulse Oximetry PCB | 401680-001 | 1 |
| 15 | | Plate, Chassis Ground, Bottom/Front | 402317-001 | 1 |
| 16 | A4 | Pulse Oximetry PCB | 401189-001 | 1 |
| 17 | | Plate, Chassis Ground, Rear | 404680-002 | 1 |
| 19 | | Spring, Compression | 402315-001 | 2 |
| 20 | | Screw, Power Supply PCB Mounting, SST, 4-40 | 402214-001 | 4 |
| 21 | | Label, Model/Serial Number | 404525-006 | 1 |
| 22 | | Power Indicator | 403170-008 | 1 |
| 23 | | Spring, Chassis Ground, Rear | 403741-001 | AR |
| 24 | | Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16 | 4505-406 | 6 |
| 25 | | Nut, Hex, 4-40 | 4521-304 | 2 |
| 26 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 45074-406 | 17 |
| 27 | | Screw, BDGH, Phillips, 4-40 x 1-3/8 | 45074-438 | 2 |
| 28 | | Spacer, Male/Female, 4-40 x 0.875 | 4656-414 | 2 |
| 29 | | Screw, 4-40 x 7/8 | 404069-001 | 2 |
| 30 | A3 | Non-Isolated Input PCB | 401315-002 | 1 |
| 31 | | Carton, Shipping | 404211-003 | 1 |
| 32 | | Foam Insert | 404211-004 | 2 |
| 33 | | Screw, BDGH, Phillips, 4-40 x 5/8 | 45074-420 | 2 |
| 34 | | Screw, BDGH, Phillips, 4-40 x 3/4 | 45074-424 | 4 |
| 35 | A6 | Interconnect PCB | 800006-001 | 1 |
| 36 | | Insulator, Bottom Shield | 404188-001 | 2 |
| 38 | | Screw, BDGH, Phillips, 4-40 x 3/8 | 45074-412 | 2 |
| 39 | | Washer, Pulse Oximetry Connector | 4550-250 | 1 |
| 40 | | Screw, FLH, Phillips, SST, 4-40 x 3/8 | 4505-412 | 2 |
| 41 | | Tram 100 - 850 A & SL Modules Service Manual | 404422-065 | – |
| 42 | | Adhesive, Diecut, Front Right | 415098-001 | 1 |
| 43 | | Screw, PHD, 4-40 x 0.188, Modified (Determined by Destination) | 409009-001 | 1 |

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 43 | | Screw, PHD, 4-40 x 0.188 (Determined by Destination) | 45074-406 | 1 |
| 44 | W3 | Harness Assembly, SpO2 - w/Choke | 700091-004 | 1 |
| 45 | | Pin, Latch | 402806-001 | 2 |
| 47 | | Button, Latch | 402106-001 | 2 |
| 48 | | Latch | 401682-001 | 2 |
| 49 | | Spring, Latch | 406019-001 | 2 |
| 50 | | Pin, Latch | 406037-001 | 2 |
| 51 | | Bracket, Power Supply PCB | 406254-001 | 1 |
| 52 | B1, W6 | Pump Assembly, NBP, w/Harness | 408169-002 | 1 |
| 53 | V1, V2, W4, W5 | NBP Valve Assembly | 416153-001 | 1 |
| 54 | A8 | NBP PCB | 800316-002 | 1 |
| 55 | | Bracket, NBP Mounting | 404296-001 | 1 |
| 56 | | Check Valve, 0.125 ID | 404675-001 | 1 |
| 57 | | Tubing, Silastic | 401582-001 | AR |
| 58 | | Filter, 43 Micron | 404679-001 | 1 |
| 59 | | Grommet, 1/4 Dia, 1/8 High, 1/16 Panel Thickness | 404749-001 | 5 |
| 60 | | Tie Wrap | 4535-002 | 1 |
| 63 | | Label, Front, English (Determined by Destination) | 411174-002 | 1 |
| 63 | | Label, Front, German (Determined by Destination) | 411174-003 | 1 |
| 63 | | Label, Front, French (Determined by Destination) | 411174-004 | 1 |
| 63 | | Label, Front, Swedish (Determined by Destination) | 411174-005 | 1 |
| 63 | | Label, Front, Spanish (Determined by Destination) | 411174-006 | 1 |
| 63 | | Label, Front, Italian (Determined by Destination) | 411174-007 | 1 |
| 63 | | Label, Front, Dutch (Determined by Destination) | 411174-008 | 1 |
| 64 | | Label, Top, English (Determined by Destination) | 411174-009 | 1 |
| 64 | | Label, Top, German (Determined by Destination) | 411174-010 | 1 |
| 64 | | Label, Top, French (Determined by Destination) | 411174-011 | 1 |
| 64 | | Label, Top, Swedish (Determined by Destination) | 411174-012 | 1 |
| 64 | | Label, Top, Spanish (Determined by Destination) | 411174-013 | 1 |
| 64 | | Label, Top, Italian (Determined by Destination) | 411174-014 | 1 |
| 64 | | Label, Top, Dutch (Determined by Destination) | 411174-015 | 1 |
| 65 | | Label, 60 Hertz (Determined by Destination) | 411091-018 | 1 |
| 65 | | Label, 50 Hertz (Determined by Destination) | 411031-019 | 1 |
| 66 | | Label, Cover, English (Determined by Destination) | 411174-016 | 1 |
| 66 | | Label, Cover, German (Determined by Destination) | 411174-020 | 1 |
| 66 | | Label, Cover, French (Determined by Destination) | 411174-021 | 1 |
| 66 | | Label, Cover, Swedish (Determined by Destination) | 411174-022 | 1 |
| 66 | | Label, Cover, Spanish (Determined by Destination) | 411174-023 | 1 |
| 66 | | Label, Cover, French (Determined by Destination) | 4111734-024 | 1 |
| 66 | | Label, Cover, International (Determined by Destination) | 411174-025 | 1 |
| 67 | | Label, TUV | 408103-002 | 1 |

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 67 | | Label, UL Listed | 408230-002 | 1 |
| 68 | | Screw, PNH, Phillips, SST, 4-40 x 3/16 | 4502-406 | 2 |
| 69 | P1 | Connector, Header, 64-Pin, w/Ferrites | 409203-001 | 1 |
| 70 | | Adhesive, Diecut, Front Left | 415098-002 | 1 |
| 76 | | Spring, Chassis Ground, Small | 414610-001 | AR |
| 77 | | Adhesive, Mylar | 415316-001 | 1 |
| 78 | | Label, CE Mark | 408230-008 | 1 |
| 79 | | PC Post, 2 x 7 | 412062-004 | 1 |
| 80 | | PC Post, 2 x 11 | 412062-005 | 1 |

# Assembly Revisions PN 411161

The baseline revision for this assembly is pn 411161-001J. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

**PN 411161-001A**

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 5 | A9 | DAS 400 Module, 10-Lead | 411167-001 | 417121-001 | 1 |
| 11 | | Label Set, Tram 400SL | 411174-001 | Not Used | 1 |
| 12 | | Module Processor PCB | 800210-002 | 800210-005 | 1 |
| 42 | | Adhesive, Loctite Prism 411 | 4851-082 | 415098-001 | AR |
| 46 | | Bezel Kit, Front | 407721-004 | Not Used | 1 |
| 53 | V1, V2, W4, W5 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 54 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |
| 57 | | NBP Tram Valve Assembly | 404459-001 | 413021-001 | 1 |
| 68 | | Screw, Phillips, STT, 4-40 x 3/16 | Not Used | 4502-406 | 2 |
| 69 | | Connector, Header 64-pin w/Ferrites | Not Used | 409203-001 | 1 |
| 70 | | Adhesive, Diecut Front Left | Not Used | 415098-002 | 1 |
| 76 | | Spring, Chassis Ground, Small | Not Used | 414610-001 | AR |
| 77 | | Adhesive, Mylar | Not Used | 415316-001 | 1 |
| 78 | | Label, CE Mark | Not Used | 408230-008 | 1 |
| 79 | | PC Post, 2 x 7 | Not Used | 412062-004 | 1 |
| 80 | | PC Post, 2 x 11 | Not Used | 412062-005 | 1 |

## PN 411161-001B

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 5 | A9 | DAS 400 Module, 10-Lead | 411167-001 | 417121-001 | 1 |
| 11 | | Label Set, Tram 400SL | 411174-001 | Not Used | 1 |
| 12 | | Module Processor PCB | 800210-002 | 800210-005 | 1 |
| 42 | | Adhesive, Loctite Prism 411 | 4851-082 | 415098-001 | AR |
| 46 | | Bezel Kit, Front | 407721-004 | Not Used | 1 |
| 53 | V1, V2, W4, W5 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 54 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |
| 68 | | Screw, Phillips, STT, 4-40 x 3/16 | Not Used | 4502-406 | 2 |
| 69 | | Connector, Header 64-pin w/Ferrites | Not Used | 409203-001 | 1 |
| 70 | | Adhesive, Diecut Front Left | Not Used | 415098-002 | 1 |
| 76 | | Spring, Chassis Ground, Small | Not Used | 414610-001 | AR |
| 77 | | Adhesive, Mylar | Not Used | 415316-001 | 1 |
| 78 | | Label, CE Mark | Not Used | 408230-008 | 1 |
| 79 | | PC Post, 2 x 7 | Not Used | 412062-004 | 1 |
| 80 | | PC Post, 2 x 11 | Not Used | 412062-005 | 1 |

## PN 411161-001C

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 5 | A9 | DAS 400 Module, 10-Lead | 411167-001 | 417121-001 | 1 |
| 12 | | Module Processor PCB | 800210-002 | 800210-005 | 1 |
| 42 | | Adhesive, Loctite Prism 411 | 4851-082 | 415098-001 | AR |
| 53 | V1, V2, W4, W5 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 54 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |
| 70 | | Adhesive, Diecut Front Left | Not Used | 415098-002 | 1 |
| 76 | | Spring, Chassis Ground, Small | Not Used | 414610-001 | AR |
| 77 | | Adhesive, Mylar | Not Used | 415316-001 | 1 |
| 78 | | Label, CE Mark | Not Used | 408230-008 | 1 |
| 79 | | PC Post, 2 x 7 | Not Used | 412062-004 | 1 |
| 80 | | PC Post, 2 x 11 | Not Used | 412062-005 | 1 |

## PN 411161-001D

This revision was a documentation change that does not affect this manual.
Refer to pn 411161-001C for changes to the parts list.

## PN 411161-001E

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 5 | A9 | DAS 400 Module, 10-Lead | 411167-001 | 417121-001 | 1 |
| 12 | | Module Processor PCB | 800210-002 | 800210-005 | 1 |
| 53 | V1, V2, W4, W5 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 54 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |
| 76 | | Spring, Chassis Ground, Small | Not Used | 414610-001 | AR |
| 77 | | Adhesive, Mylar | Not Used | 415316-001 | 1 |
| 78 | | Label, CE Mark | Not Used | 408230-008 | 1 |
| 79 | | PC Post, 2 x 7 | Not Used | 412062-004 | 1 |
| 80 | | PC Post, 2 x 11 | Not Used | 412062-005 | 1 |

## PN 411161-001F

This revision was a documentation change that does not affect this manual.
Refer to pn 411161-001E for changes to the parts list.

## PN 411161-001G

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 5 | A9 | DAS 400 Module, 10-Lead | 411167-001 | 417121-001 | 1 |
| 53 | V1, V2, W4, W5 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 54 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |

## PN 411161-001H

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 5 | A9 | DAS 400 Module, 10-Lead | 411167-001 | 417121-001 | 1 |
| 54 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |

*For your notes*

# 11 TRAM 450SL MODULE

# PN 412654

**General** ........................................................................................ **11-2**
  Circuit Boards........................................................................ 11-2

**Exploded View PN 412654-001H** ...................................................... **11-3**

**Schematic Diagram PN 412654-001H** ................................................ **11-5**

**Parts List PN 412654-001H** ............................................................ **11-7**

**Assembly Revisions PN 412654**........................................................ **11-10**

# General

## Circuit Boards

Details about the circuit boards contained in the Tram 450SL are discussed in later chapters arranged by part number.

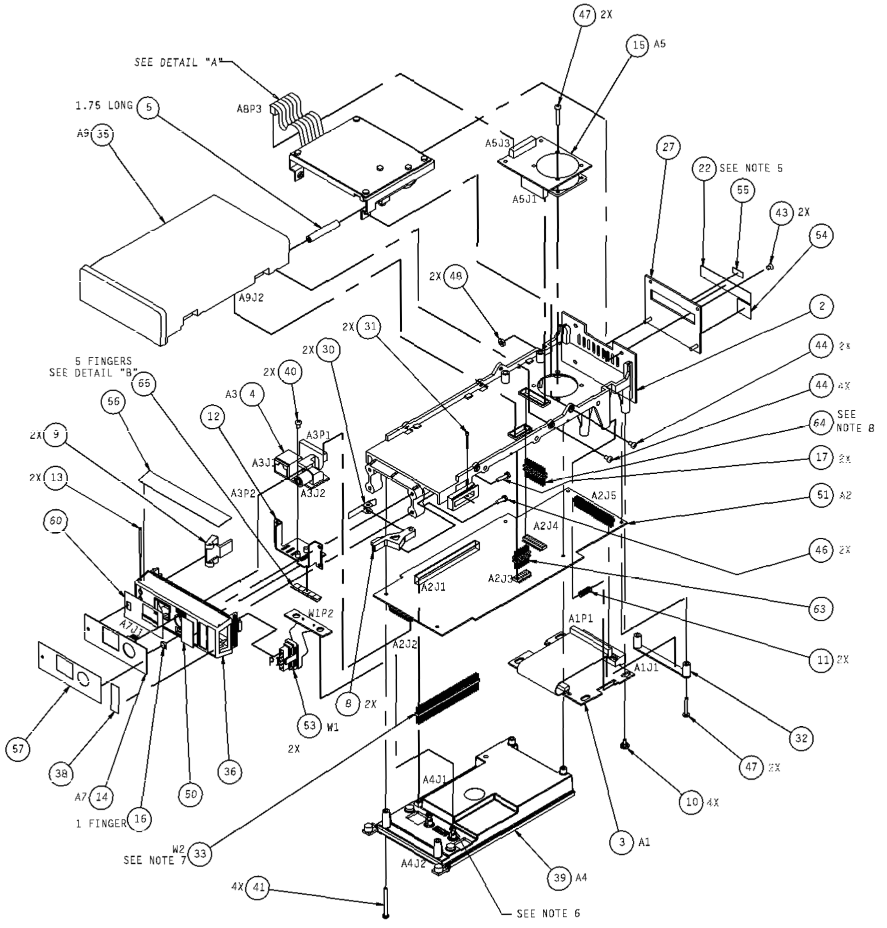
**Table 8-1. Circuit Board Overview**

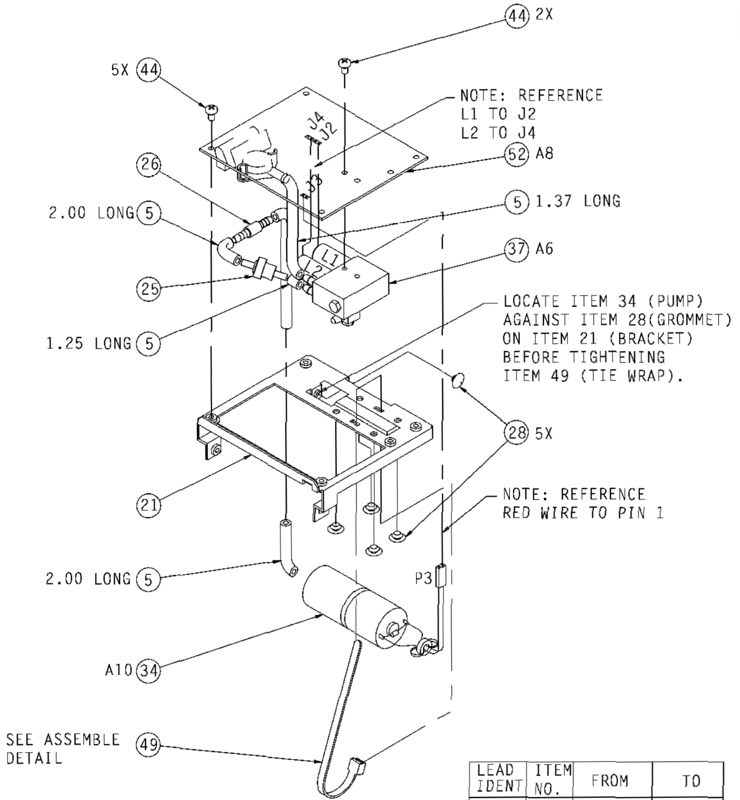
| Module Type | Upper Level | Leadwire Configuration | DAS Module | Acquisition Processor PCB | Module Processor PCB |
|---|---|---|---|---|---|
| Tram 450SL | 412654-001A-G | 10-Leadwire | 411167-001 | 800330-010 | 800210-005 |
| Tram 450SL | 412654-001H | 10-Leadwire | 417121-001 (Replaces 411167-001) | 801040-001 | 800210-005 |

# Exploded View

# PN 412654-001H

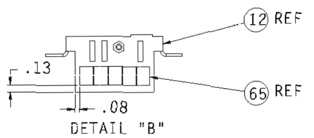
1 of 2


47 2X
15 A5
SEE DETAIL "A"
A8P3
1.75 LONG 5
A9 35
A5J3
A5J1
27
22 SEE NOTE 5
55
43 2X
54
2
44 2X
44 4X
64 SEE NOTE 8
17 2X
51 A2
46 2X
63
11 2X
32
47 2X
10 4X
3 A1
39 A4
SEE NOTE 6
A9J2
2X 48
2X 31
2X 30
2X 40
A3 4
12
5 FINGERS SEE DETAIL "B"
65
56
2X 9
2X 13
60
A3P1
A3J1
A3J2
A3P2
A2J5
A2J4
A2J3
A2J1
A2J2
A1P1
A1J1
W1P2
A7J1
53 W1
2X
8 2X
A4J1
A4J2
57
38
A7 14
1 FINGER 16
50
36
W2 SEE NOTE 7 33
4X 41


44 2X
5X 44
NOTE: REFERENCE L1 TO J2 L2 TO J4
J4
J2
L1
52 A8
26
2.00 LONG 5
5 1.37 LONG
37 A6
25
1.25 LONG 5
LOCATE ITEM 34 (PUMP) AGAINST ITEM 28(GROMMET) ON ITEM 21 (BRACKET) BEFORE TIGHTENING ITEM 49 (TIE WRAP).
28 5X
21
NOTE: REFERENCE RED WIRE TO PIN 1
2.00 LONG 5
P3
A10 34
SEE ASSEMBLE DETAIL 49

| LEAD IDENT | ITEM NO. | FROM | TO |
|---|---|---|---|
| P1 | 37 | A6P1 | A8J2 |
| P2 | 37 | A6P2 | A8J4 |
| P3 | 34 | A10P3 | A8J3 |

DETAIL "A"

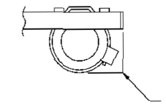

12 REF
65 REF
.13
.08

DETAIL "B"

(LOCATE APPROXIMATELY AS SHOWN)
(BOTTOM VIEW OF ITEM 12)

NOTES:

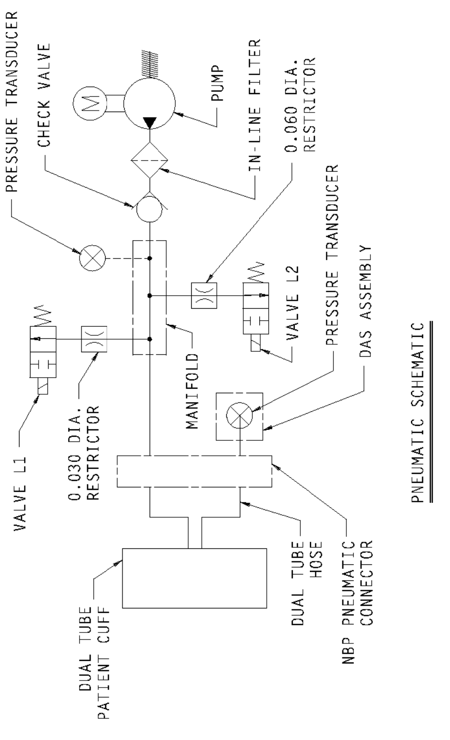
1. *WHEN SHIELD (ITEM 7) IS INSTALLED, THE TAB SHOULD TUCK INTO THE* FRONT BEZEL (ITEM 36) AND BE IN CONTACT WITH THE SHIELDING FINGERS (ITEM 16) ON THE BOTTOM OF THE BRACKET (ITEM 12).
2. SWITCH SETTINGS MUST BE MADE FOR EACH CONFIGURATION (SEE SWITCH CHART SHEET 2).
3. CHECK APPROPRIATE BOX ON SIDE OF CARTON TO INDICATE UNIT BEING SHIPPED.
4. *LOOSE ITEMS MAY BE SHIPPED WITH THE UNIT* IF SPACE PERMITS OR PACKAGED AND SHIPPED SEPARATELY.
5. MARK LABEL WITH MODEL NUMBER, SERIAL NUMBER, AND BAR CODE.
6. INSERT TWO HOLES OF FLEX PCB (ITEM 53) ONTO 1/4-TURN STANDOFF (ITEM 39) UNTIL CONNECTOR ON PCB FLEX BOTTOMS OUT. THEN LOCK THE STANDOFFS BY TURNING THE HEX SCREW OF THE STANDOFF 1/4-TURN CLOCKWISE.
7. INSERT THE SHORT LEADS OF CONNECTOR (ITEM 33) INTO PCB TRAM CPU (ITEM 51).
8. INSERT LONGER PIN SIDE INTO ITEM 51. PINS MUST EXTEND BEYOND MATING CONNECTOR ON ITEM 51 WHEN ASSEMBLED.



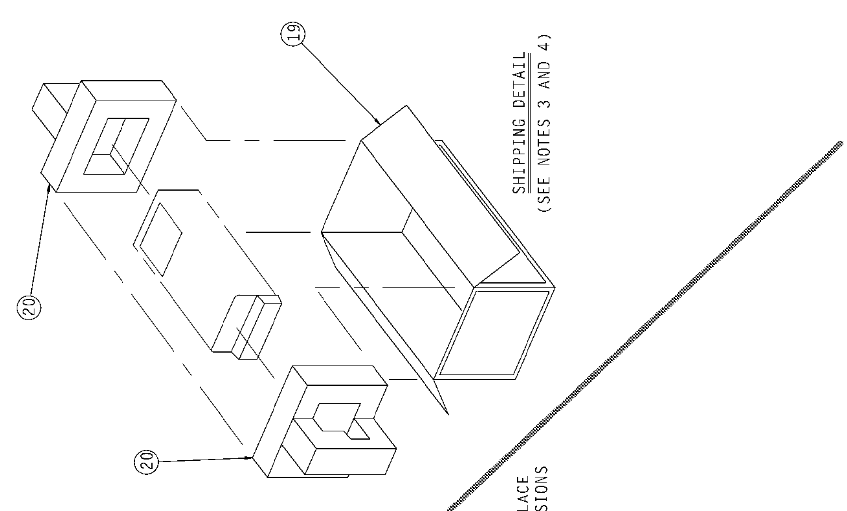
ASSEMBLED DETAIL

NOTE: HEAD OF TIE WRAP ITEM 49 MUST NOT BREAK EITHER OF THESE PLANES AFTER ASSEMBLY.

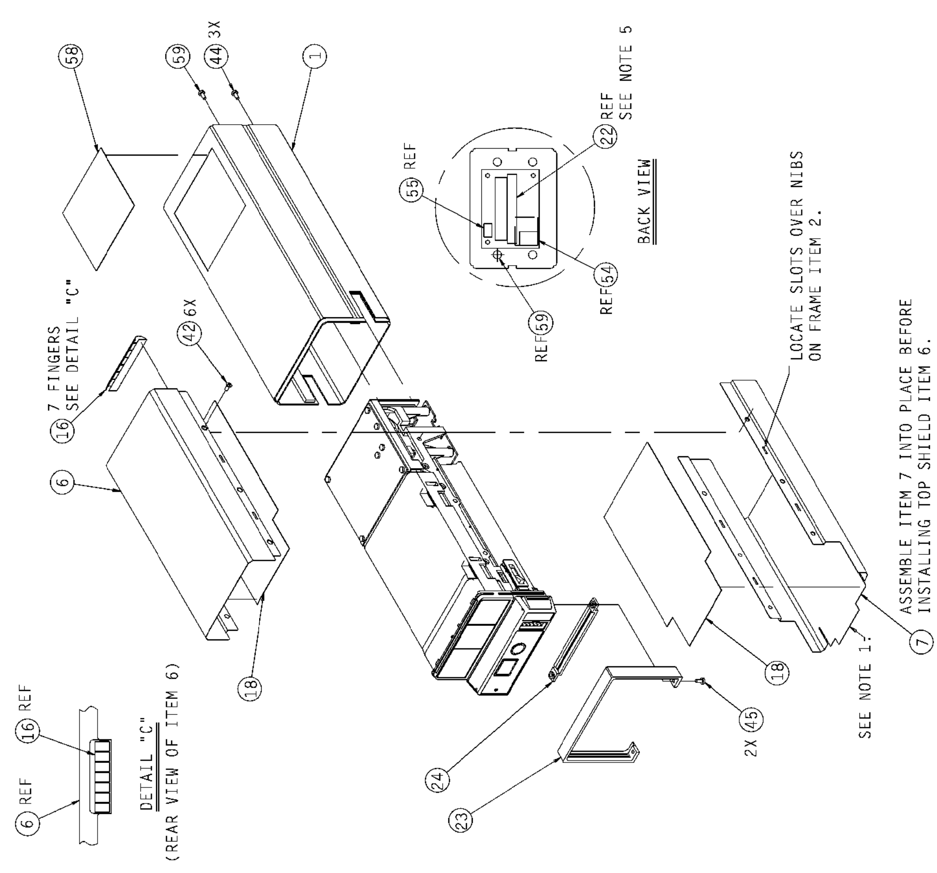
2 of 2

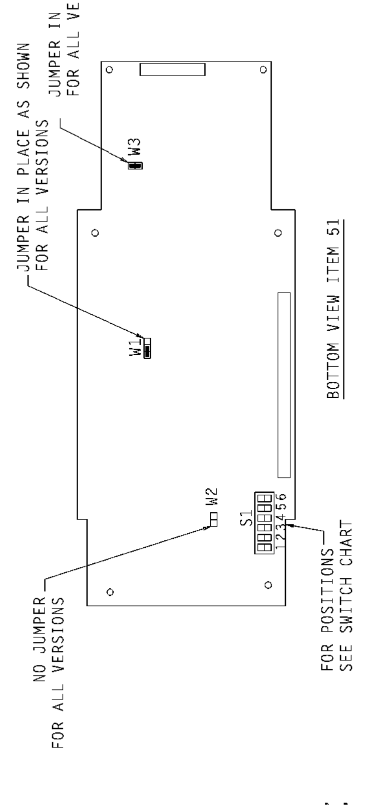

PRESSURE TRANSDUCER
CHECK VALVE
PUMP
M
IN-LINE FILTER
0.060 DIA. RESTRICTOR
PRESSURE TRANSDUCER
VALVE L2
DAS ASSEMBLY
MANIFOLD
VALVE L1
0.030 DIA. RESTRICTOR
DUAL TUBE HOSE
NBP PNEUMATIC CONNECTOR
DUAL TUBE PATIENT CUFF

PNEUMATIC SCHEMATIC



SHIPPING DETAIL
(SEE NOTES 3 AND 4)


58
59
44 3X
1
REF SEE NOTE 5
22
55 REF
BACK VIEW
REF 54
REF 59
LOCATE SLOTS OVER NIBS ON FRAME ITEM 2.
16 7 FINGERS SEE DETAIL "C"
42 6X
6
ASSEMBLE ITEM 7 INTO PLACE BEFORE INSTALLING TOP SHIELD ITEM 6.
7
SEE NOTE 1.
18
18
2X 45
24
23
16 REF
6 REF
DETAIL "C"
(REAR VIEW OF ITEM 6)


JUMPER IN PLACE AS SHOWN
JUMPER IN PLACE FOR ALL VERSIONS
W3
JUMPER IN PLACE FOR ALL VERSIONS
W1
W2
NO JUMPER FOR ALL VERSIONS
S1
123456
FOR POSITIONS SEE SWITCH CHART

BOTTOM VIEW ITEM 51

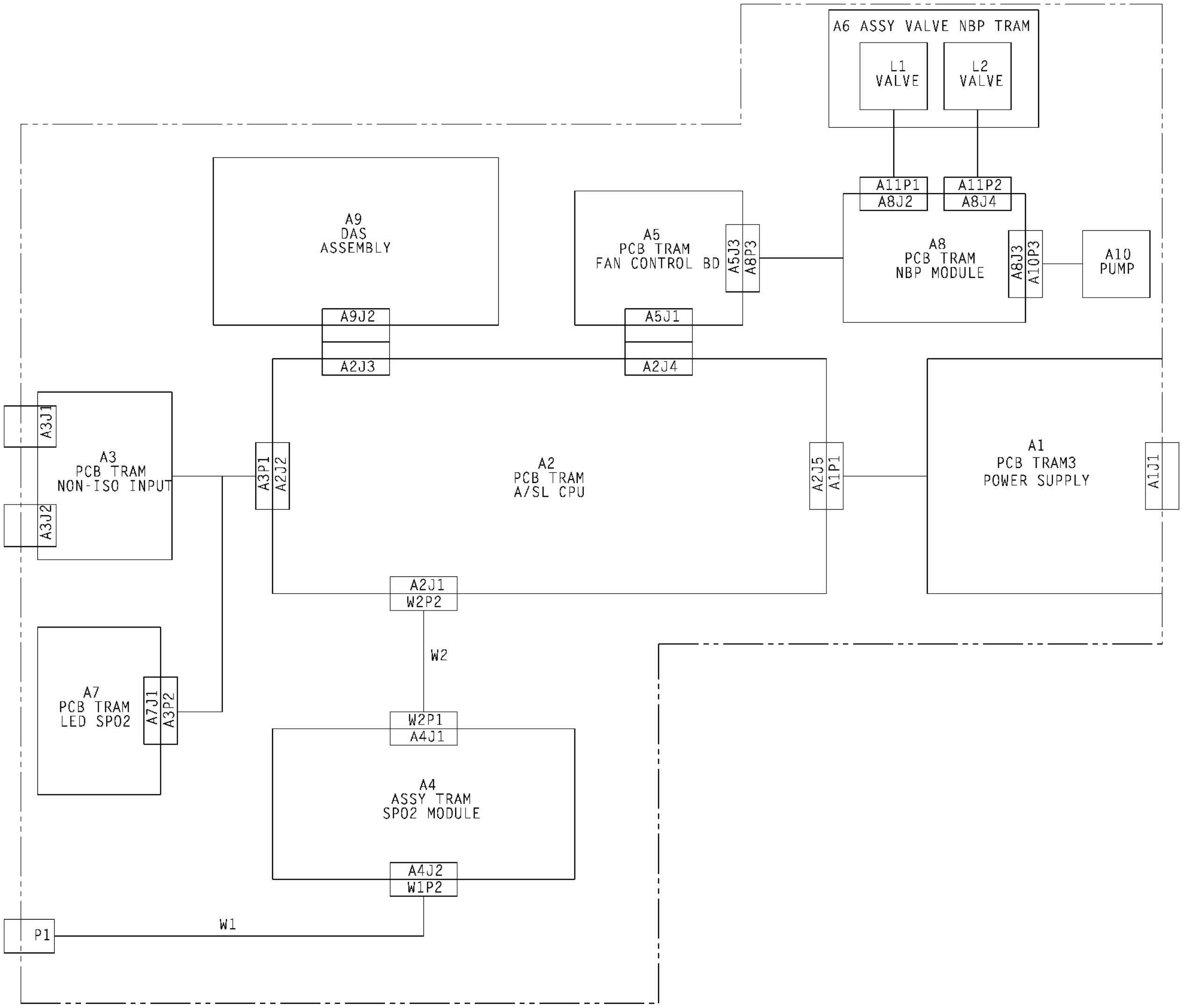
SWITCH CHART
(SEE NOTE 2)

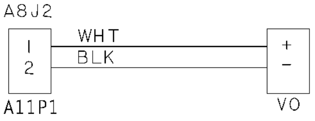
■ =ON
□ =OFF

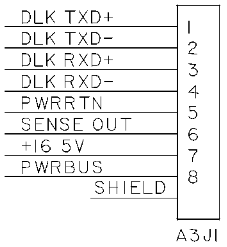
| DESCRIPTION | SW1 123456 | OMAR NUMBER |
|---|---|---|
| ENG 60HZ | □□□□□□ | T250<br>T450<br>T850<br>T850SL =A,G |
| ENG 50HZ | □□□□□■ | T250<br>T450<br>T850<br>T850SL =A5 |
| SI 60HZ | □□□□■□ | T250<br>T450<br>T850<br>T850SL =Q |
| SI 50HZ | □□□□■■ | T250<br>T450<br>T850<br>T850SL =S,H, T,J, P,W |

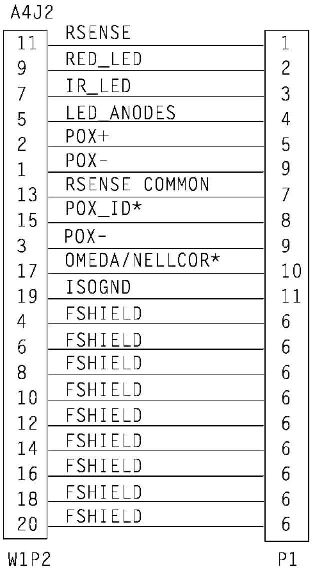
# Schematic Diagram PN 412654-001H

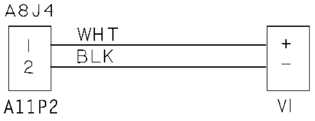
1 of 2

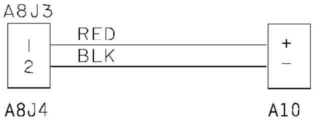

A6 ASSY VALVE NBP TRAM
L1 VALVE
L2 VALVE
A11P1
A8J2
A11P2
A8J4
A9 DAS ASSEMBLY
A9J2
A5 PCB TRAM FAN CONTROL BD
A5J3
A8P3
A5J1
A8 PCB TRAM NBP MODULE
A8J3
A10P3
A10 PUMP
A2J3
A2J4
A3J1
A3 PCB TRAM NON-ISO INPUT
A3J2
A3P1
A2J2
A2 PCB TRAM A/SL CPU
A2J5
A1P1
A1 PCB TRAM3 POWER SUPPLY
A1J1
A2J1
W2P2
W2
A7 PCB TRAM LED SPO2
A7J1
A3P2
W2P1
A4J1
A4 ASSY TRAM SPO2 MODULE
A4J2
W1P2
P1
W1

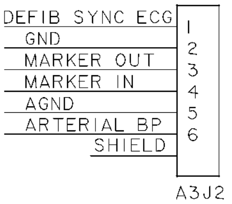

A8J2
1
2
WHT
BLK
+
−
A11P1
VO


DLK TXD+
DLK TXD-
DLK RXD+
DLK RXD-
PWRRTN
SENSE OUT
+16 5V
PWRBUS
SHIELD
1
2
3
4
5
6
7
8
A3J1


A4J2
11 RSENSE 1
9 RED_LED 2
7 IR_LED 3
5 LED_ANODES 4
2 POX+ 5
1 POX- 9
13 RSENSE COMMON 7
15 POX_ID* 8
3 POX- 9
17 OMEDA/NELLCOR* 10
19 ISOGND 11
4 FSHIELD 6
6 FSHIELD 6
8 FSHIELD 6
10 FSHIELD 6
12 FSHIELD 6
14 FSHIELD 6
16 FSHIELD 6
18 FSHIELD 6
20 FSHIELD 6
W1P2
P1


A8J4
1
2
WHT
BLK
+
−
A11P2
VI


A8J3
1
2
RED
BLK
+
−
A8J4
A10


DEFIB SYNC ECG
GND
MARKER OUT
MARKER IN
AGND
ARTERIAL BP
SHIELD
1
2
3
4
5
6
A3J2

**2 of 2**

| Signal | A1J1 |
|---|---|
| AGND | A1 |
| XMIT EN* | A2 |
| SYNC ECG RTN | A3 |
| SYNC ECG(10MV/V) | A4 |
| MOD DATA CLK* | A5 |
| MOD ATA IN | A6 |
| MOD DATA OUT | A7 |
| MOD DATA LCH* | A8 |
| BP3 | A9 |
| NC | A10 |
| GND | A11 |
| BKPLANE ID | A12 |
| NC | A13 |
| NC | A14 |
| AGND | A15 |
| ART BP | B1 |
| MOD ENABLE | B2 |
| BP2 | B3 |
| +16 5V | B4 |
| PWRBU | B5 |
| TRC2/ECG1 | B6 |
| TRC1/ECG11 | B7 |
| RESP/ECGV | B8 |
| NC | B9 |
| BP4 | B10 |
| GND | B11 |
| +5V | B12 |
| NC | B13 |
| NC | B14 |
| AGND | B15 |

| A2J4 | Signal | A5J1 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRRTN | 2 |
| 3 | PWRBUS | 3 |
| 4 | PWRRTN | 4 |
| 5 | NIBP P7 | 5 |
| 6 | SPARE | 6 |
| 7 | NIBP P6 | 7 |
| 8 | +5V | 8 |
| 9 | NIBP P5 | 9 |
| 10 | GND | 10 |
| 11 | NIBP P4 | 11 |
| 12 | FAN ENBL* | 12 |
| 13 | NIBP P3 | 13 |
| 14 | NIBP ENBL* | 14 |
| 15 | NIBP P2 | 15 |
| 16 | NIBP IO* | 16 |
| 17 | NIBP P1 | 17 |
| 18 | NIBP RD* | 18 |
| 19 | NIBP P0 | 19 |
| 20 | NIBP WR* | 20 |
| 21 | NIBP SEL0 | 21 |
| 22 | NIBP SEL1 | 22 |

| A2J5 / A1P1 | Signal | A1J2 |
|---|---|---|
| 1 | ART BP | 1 |
| 2 | SYNC ECG RTN | 2 |
| 3 | BP2 | 3 |
| 4 | SYNC ECG(10MV/V) | 4 |
| 5 | BP3 | 5 |
| 6 | BP4 | 6 |
| 7 | TRC2/ECG1 | 7 |
| 8 | TRC1/ECG11 | 8 |
| 9 | RESP/ECGV | 9 |
| 10 | SPARE | 10 |
| 11 | SPARE | 11 |
| 12 | AGND | 12 |
| 13 | -12 8 ANALOG | 13 |
| 14 | AGND | 14 |
| 15 | +12 8 ANALOG | 15 |
| 16 | +5 0 ANALOG | 16 |
| 17 | 5 0 RTN | 17 |
| 18 | -5 0 ANALOG | 18 |
| 19 | 5 0 RTN | 19 |
| 20 | XMIT EN* | 20 |
| 21 | MOD ENABLE | 21 |
| 22 | MOD DATA CLK* | 22 |
| 23 | MOD DATA IN | 23 |
| 24 | GND | 24 |
| 25 | MOD DATA OUT | 25 |
| 26 | GND | 26 |
| 27 | MOD DATA LCH* | 27 |
| 28 | BKPLANE ID | 28 |
| 29 | +5V | 29 |
| 30 | +5V BOOT | 30 |
| 31 | +5V | 31 |
| 32 | SPARE | 32 |
| 33 | +15 5V | 33 |
| 34 | PWRRTN | 34 |
| 35 | PWRRTN | 35 |
| 36 | +16 5V | 36 |
| 37 | +16 5V | 37 |
| 38 | SPARE | 38 |
| 39 | PWRBUS | 39 |
| 40 | PWRBUS | 40 |

| A9J2 | Signal | A2J3 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRBUS | 2 |
| 3 | PWRRTN | 3 |
| 4 | PWRRTN | 4 |
| 5 | SPARE | 5 |
| 6 | SPARE | 6 |
| 7 | GND | 7 |
| 8 | DAS GTXD | 8 |
| 9 | GND | 9 |
| 10 | DAS GRXD | 10 |
| 11 | +5V | 11 |
| 12 | DAS GDEN* | 12 |
| 13 | +5V | 13 |
| 14 | DAS ENBL* | 14 |

| A3J3 / W2P2 | Signal | A2J2 / W2P1 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRBUS | 2 |
| 3 | +16 5V | 3 |
| 4 | +16 5V | 4 |
| 5 | PWRRTN | 5 |
| 6 | PWRRTN | 6 |
| 7 | DLK RXD+ | 7 |
| 8 | DLK RXD- | 8 |
| 9 | DLK TXD+ | 9 |
| 10 | DLK TXD- | 10 |
| 11 | DSYNC OUT | 11 |
| 12 | GND | 12 |
| 13 | MARKER RTN | 13 |
| 14 | GND | 14 |
| 15 | SPARE | 15 |
| 16 | SPARE | 16 |
| 17 | DSYNC ECG | 17 |
| 18 | AGND | 18 |
| 19 | BUF ART BP | 19 |
| 20 | AGND | 20 |

| A7J1 / A3P1 | Signal | A2J2 / W2P1 |
|---|---|---|
| 1 | PWR LED | 21 |
| 2 | SPARE | 22 |
| 3 | SPARE | 23 |
| 4 | GND | 24 |

| A5J3 | Signal | A8P3 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRRTN | 2 |
| 3 | PWRBUS | 3 |
| 4 | PWRRTN | 4 |
| 5 | NIBP P7 | 5 |
| 6 | SPARE | 6 |
| 7 | NIBP P6 | 7 |
| 8 | +12V SW | 8 |
| 9 | NIBP P5 | 9 |
| 10 | +12V SW | 10 |
| 11 | NIBP P4 | 11 |
| 12 | SPARE | 12 |
| 13 | NIBP P3 | 13 |
| 14 | NIBP ENBL* | 14 |
| 15 | NIBP P2 | 15 |
| 16 | NIBP IO* | 16 |
| 17 | NIBP P1 | 17 |
| 18 | NIBP RD* | 18 |
| 19 | NIBP P0 | 19 |
| 20 | NIBP WR* | 20 |
| 21 | NIBP SEL0 | 21 |
| 22 | NIBP SEL1 | 22 |
| 23 | GND | 23 |
| 24 | +5V | 24 |

| A4J1 / W2P1 | Signal | A2J1 / W2P2 |
|---|---|---|
| 1 | NC | 1 |
| 2 | NC | 2 |
| 3 | NC | 3 |
| 4 | GND | 4 |
| 5 | NC | 5 |
| 6 | GND | 6 |
| 7 | NC | 7 |
| 8 | GND | 8 |
| 9 | NC | 9 |
| 10 | NC | 10 |
| 11 | NC | 11 |
| 12 | GND | 12 |
| 13 | NC | 13 |
| 14 | NC | 14 |
| 15 | NC | 15 |
| 16 | NC | 16 |
| 17 | NC | 17 |
| 18 | NC | 18 |
| 19 | NC | 19 |
| 20 | NC | 20 |
| 21 | NC | 21 |
| 22 | GND | 22 |
| 23 | NC | 23 |
| 24 | GND | 24 |
| 25 | NC | 25 |
| 26 | GND | 26 |
| 27 | OPER/TEST* | 27 |
| 28 | PA7 | 28 |
| 29 | SLOW/FAST* | 29 |
| 30 | PA6 | 30 |
| 31 | GND | 31 |
| 32 | PA5 | 32 |
| 33 | GND | 33 |
| 34 | PA4 | 34 |
| 35 | PAR/LCD* | 35 |
| 36 | PA3 | 36 |
| 37 | GND | 37 |
| 38 | PA2 | 38 |
| 39 | GND | 39 |
| 40 | PA1 | 40 |
| 41 | MINX RESET* | 41 |
| 42 | PA0 | 42 |
| 43 | PULSE | 43 |
| 44 | OBF* | 44 |
| 45 | INT DET | 45 |
| 46 | ACK* | 46 |
| 47 | CALIB OK | 47 |
| 48 | IBF | 48 |
| 49 | SPARE | 49 |
| 50 | STB* | 50 |
| 51 | LQS | 51 |
| 52 | NC | 52 |
| 53 | NO PRB | 53 |
| 54 | RXD* | 54 |
| 55 | PRB OFF | 55 |
| 56 | NC | 56 |
| 57 | LO SAT | 57 |
| 58 | +5 0 ANALOG | 58 |
| 59 | 5 0 RTN | 59 |
| 60 | -5 0 ANALOG | 60 |
| 61 | +5V | 61 |
| 62 | +5V | 62 |
| 63 | GND | 63 |
| 64 | GND | 64 |

# Parts List PN 412654-001H

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 1 | | Cover, Module | 400895-001 | 1 |
| 2 | | Frame | 400982-001 | 1 |
| 3 | A1 | Power Supply PCB | 401309-002 | 1 |
| 4 | A3 | Non-Isolated Input PCB | 401315-002 | 1 |
| 5 | | Tubing, Silastic | 401582-001 | AR |
| 6 | | Shield, Top | 401679-001 | 1 |
| 7 | | Shield, Bottom | 401679-002 | 1 |
| 8 | | Latch | 401682-001 | 2 |
| 9 | | Button, Latch | 402106-001 | 2 |
| 10 | | Screw, Shoulder | 402214-001 | 4 |
| 11 | | Spring, Compression | 402315-001 | 2 |
| 12 | | Plate, Chassis Ground, Bottom/Front | 402317-001 | 1 |
| 13 | | Pin, Latch | 402806-001 | 2 |
| 14 | A7 | Power Indicator PCB | 403170-011 | 1 |
| 15 | A5 | Fan PCB | 403549-002 | 1 |
| 16 | | Spring, Chassis Ground, Rear | 403741-001 | AR |
| 17 | | Screw, BDGH, Phillips, 4-40 x 7/8 | 404069-001 | 2 |
| 18 | | Insulator, Bottom Shield | 404188-001 | 2 |
| 19 | | Carton, Shipping | 404211-003 | 1 |
| 20 | | Foam, Insert | 404211-004 | 1 |
| 21 | | Bracket, NBP Mounting | 404296-001 | 1 |
| 22 | | Label, Blank | 404525-006 | 1 |
| 23 | | Trim, Rubber, Front Bezel | 404620-001 | 1 |
| 24 | | Mounting Strap, Trim | 404621-001 | 1 |
| 25 | | Check Valve, 0.125 ID | 404675-001 | 1 |
| 26 | | Filter, 43 Micron | 404679-001 | 1 |
| 27 | | Plate, Chassis Ground, Rear | 404680-002 | 1 |
| 28 | | Grommet, 1/4 Dia, 1/8 High, 1/16 Panel Thickness | 404749-001 | 5 |
| 30 | | Spring, Latch | 406019-001 | 2 |
| 31 | | Pin, Latch | 406037-001 | 2 |
| 32 | | Bracket, Power Supply PCB | 406254-001 | 1 |
| 33 | W2 | Connector, Header, Dual, 64-Pin | 407452-002 | 1 |
| 34 | A10 | Pump Assembly, NBP, w/Harness | 408169-002 | 1 |
| 35 | A9 | 400 Acquisition Module, 10-Lead | 417121-001 | 1 |
| 36 | | Front Bezel, Tram | 412659-001 | 1 |
| 37 | A6 | NBP Valve Assembly | 416153-002 | 1 |
| 38 | | Label, Pulse Oximetry, Nellcor | 413831-002 | 1 |
| 39 | A4 | Pulse Oximetry Assembly (Including Pulse Oximetry PCB, PN 800674-00X) | 414409-001 | 1 |
| 40 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 4502-406 | 2 |
| 41 | | Screw, BDGH, Phillips, 4-40 x 1-1/4 | 4502-440 | 4 |

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 42 | | Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16 | 4505-406 | 6 |
| 43 | | Screw, FLH, Phillips, SST, 4-40 x 3/8 | 4505-412 | 2 |
| 44 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 45074-406 | 16 |
| 45 | | Screw, BDGH, Phillips, 4-40 x 3/8 | 45074-412 | 2 |
| 46 | | Screw, BDGH, Phillips, 4-40 x 5/8 | 45074-420 | 2 |
| 47 | | Screw, BDGH, Phillips, 4-40 x 3/4 | 45074-424 | 4 |
| 48 | | Nut, Hex, 4-40 | 4521-304 | 2 |
| 49 | | Tie Wrap | 4535-002 | 1 |
| 50 | | Adhesive, Diecut, Front Right | 415098-003 | 1 |
| 51 | A2 | Module Processor PCB | 800210-005 | 1 |
| 52 | A8 | NPB PCB | 800316-002 | 1 |
| 53 | W1 | Harness, Pulse Oximetry PCB-to-Connector | 800892-001 | 1 |
| 54 | | Label, UL (Determined by Destination) | 408230-002 | 1 |
| 55 | | Label, 60 Hertz | 411091-018 | 1 |
| 55 | | Label, 50 Hertz | 411091-019 | 1 |
| 56 | | Label, Top, English (Determined by Destination) | 411174-009 | 1 |
| 56 | | Label, Top, German (Determined by Destination) | 411174-010 | 1 |
| 56 | | Label, Top, French (Determined by Destination) | 411174-011 | 1 |
| 56 | | Label, Top, Swedish (Determined by Destination) | 411174-012 | 1 |
| 56 | | Label, Top, Spanish (Determined by Destination) | 411174-013 | 1 |
| 56 | | Label, Top, Italian (Determined by Destination) | 411174-014 | 1 |
| 56 | | Label, Top, Dutch (Determined by Destination) | 411174-015 | 1 |
| 57 | | Label, Front, 450SL, English (Determined by Destination) | 413837-001 | 1 |
| 57 | | Label, Front, 450SL, German (Determined by Destination) | 413837-002 | 1 |
| 57 | | Label, Front, 450SL, French (Determined by Destination) | 413837-003 | 1 |
| 57 | | Label, Front, 450SL, Swedish (Determined by Destination) | 413837-004 | 1 |
| 57 | | Label, Front, 450SL, Spanish (Determined by Destination) | 413837-005 | 1 |
| 57 | | Label, Front, 450SL, Italian (Determined by Destination) | 413837-006 | 1 |
| 57 | | Label, Front, 450SL, Dutch (Determined by Destination) | 413837-007 | 1 |
| 58 | | Label, Cover, English (Determined by Destination) | 414047-001 | 1 |
| 58 | | Label, Cover, German (Determined by Destination) | 414047-002 | 1 |
| 58 | | Label, Cover, French (Determined by Destination) | 414047-003 | 1 |
| 58 | | Label, Cover, Swedish (Determined by Destination) | 414047-004 | 1 |
| 58 | | Label, Cover, Spanish (Determined by Destination) | 414047-005 | 1 |
| 58 | | Label, Cover, Italian (Determined by Destination) | 414047-006 | 1 |
| 58 | | Label, Cover, International (Determined by Destination) | 414047-007 | 1 |
| 59 | | Spring, Chassis Ground, Small | 414610-001 | AR |

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 59 | | Screw, PHD, 4-40 x 0.188, Modified (Determined by Destination) | 409009-001 | 1 |
| 59 | | Screw, PHD, 4-40 x 0.188 (Determined by Destination) | 45074-406 | 1 |
| 60 | | Adhesive, Diecut, Front Left | 415098-002 | 1 |
| 61 | | Tram 100 - 850 A and SL Module Service Manual | 404422-065 | 1 |
| 62 | | Label, CE Mark | 408230-008 | 1 |
| 63 | | PC Post, 2 x 7 | 412062-004 | 1 |
| 64 | | PC Post, 2 x 11 | 412062-005 | 1 |

# Assembly Revisions PN 412654

The baseline revision for this assembly is pn 412654-001H. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

## PN 412654-001A

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 35 | A9 | DAS 400 Module, 10-Lead | 411167-001 | 417121-001 | 1 |
| 37 | A6 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 50 |  | Adhesive, Loctite Prism 411 | 4851-082 | 415098-001 | AR |
| 51 |  | Module Processor PCB | 800210-002 | 800210-005 | 1 |
| 52 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |
| 59 |  | Spring, Chassis Ground, Small | Not Used | 414610-001 | AR |
| 60 |  | Adhesive, Diecut, Front Left | Not Used | 415098-002 | 1 |
| 62 |  | Label, CE Mark | Not Used | 408230-008 | 1 |
| 63 |  | PC Post, 2 x 7 | Not Used | 412062-004 | 1 |
| 64 |  | PC Post, 2 x 11 | Not Used | 412062-005 | 1 |

## PN 412654-001B

This revision was a documentation change that does not affect this manual.
Refer to pn 412654-001A for changes to the parts list.

## PN 412654-001C

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 35 | A9 | DAS 400 Module, 10-Lead | 411167-001 | 417121-001 | 1 |
| 37 | A6 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 51 |  | Module Processor PCB | 800210-002 | 800210-005 | 1 |
| 52 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |
| 62 |  | Label, CE Mark | Not Used | 408230-008 | 1 |
| 63 |  | PC Post, 2 x 7 | Not Used | 412062-004 | 1 |
| 64 |  | PC Post, 2 x 11 | Not Used | 412062-005 | 1 |

## PN 412654-001D

This revision was a documentation change that does not affect this manual.
Refer to pn 412654-001C for changes to the parts list.

## PN 412654-001E

This revision was a documentation change that does not affect this manual.
Refer to pn 412654-001C for changes to the parts list.

## PN 412654-001F

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 35 | A9 | DAS 400 Module, 10-Lead | 411167-001 | 417121-001 | 1 |
| 37 | A6 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 52 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |

## PN 412651-001G

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 35 | A9 | DAS 400 Module, 10-Lead | 411167-001 | 417121-001 | 1 |
| 52 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |

*For your notes*

# 12 TRAM 500A MODULE

# PN 408003

**General** ........................................ **12-2**
  Circuit Boards ........................................ 12-2
  Tram 500A Configurations ........................................ 12-2

**Exploded View PN 408003C** ........................................ **12-3**

**Schematic Diagram PN 408003C** ........................................ **12-5**

**Parts List PN 408003C** ........................................ **12-7**

**Assembly Revisions PN 408003** ........................................ **12-9**

# General

## Circuit Boards

Details about the circuit boards contained in the Tram 500A are discussed in later chapters arranged by part number.

**Table 12-1. Circuit Board Overview**

| Module Type | Upper Level | Leadwire Configuration | DAS Module | Acquisition Processor PCB | Module Processor PCB |
|---|---|---|---|---|---|
| Tram 500A | 408003-0XX | 5-Leadwire | 408133-001 | 800330-002 | 800210-005 |

## Tram 500A Configurations

At the time of this writing, we make 16 configurations of the Tram 500A module. The differences between configurations are in the power frequency, the type of labelling, and the units of measure used. The table below lists the available configurations.

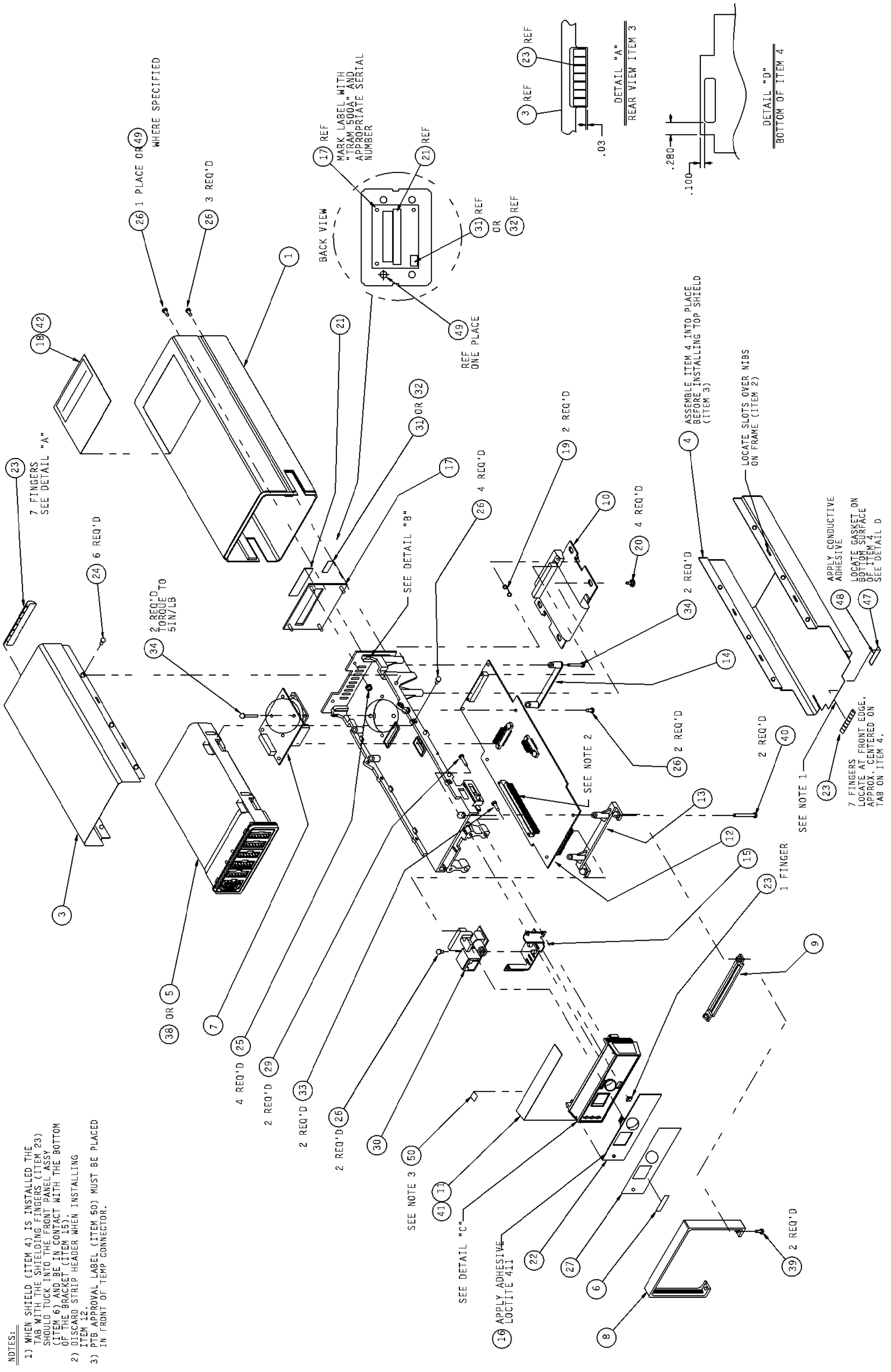
**Table 12-2.**

| Part Number | Rev | Power *f* (Hz) | Labels | Units of Measure |
|---|---|---|---|---|
| 408003-001 | B | 60 | English | English |
| 408003-002 | A | 50 | English | English |
| 408003-003 | B | 60 | English | English |
| 408003-004 | A | 50 | English | English |
| 408003-005 | A | 60 | English | SI |
| 408003-006 | A | 50 | English | SI |
| 408003-007 | A | 60 | English | SI |
| 408003-008 | A | 50 | English | SI |
| 408003-011 | A | 60 | Icon | English |
| 408003-012 | A | 50 | Icon | English |
| 408003-013 | A | 60 | Icon | English |
| 408003-014 | A | 50 | Icon | English |
| 408003-015 | A | 60 | Icon | SI |
| 408003-016 | B | 50 | Icon | SI |
| 408003-017 | A | 60 | Icon | SI |
| 408003-018 | B | 50 | Icon | SI |

Part number 408003A without a dashed suffix (ie, pn 408003A, as opposed to pn 408003-001A or pn 408003-002A) refers to all of the assemblies listed in the table above. Unless otherwise noted, all assemblies are the same.

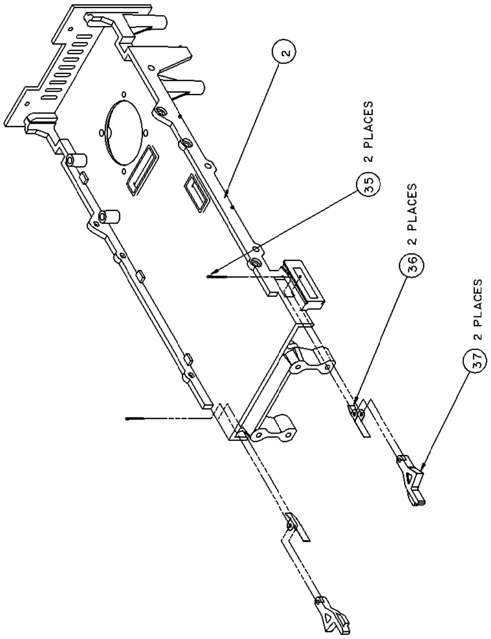
# Exploded View PN 408003C

1 of 2

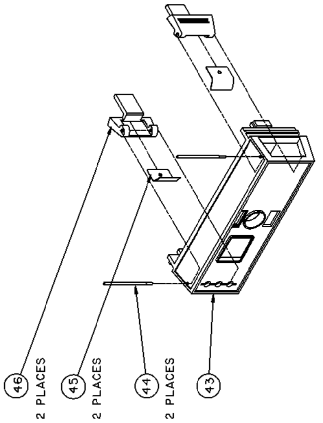

DETAIL "A"
REAR VIEW ITEM 3
3 REF
23 REF
.03
DETAIL "D"
BOTTOM OF ITEM 4
.280
.100
26 1 PLACE OR 49 WHERE SPECIFIED
26 3 REQ'D
17 REF
MARK LABEL WITH "TRAM 500A" AND APPROPRIATE SERIAL NUMBER
21 REF
BACK VIEW
31 REF OR 32 REF
49 REF ONE PLACE
1
18 42
21
31 OR 32
17
23 7 FINGERS SEE DETAIL "A"
24 6 REQ'D
34 2 REQ'D TORQUE TO 5IN/LB
SEE DETAIL "B"
26 4 REQ'D
19 2 REQ'D
10
20 4 REQ'D
4 ASSEMBLE ITEM 4 INTO PLACE BEFORE INSTALLING TOP SHIELD (ITEM 3)
LOCATE SLOTS OVER NIBS ON FRAME (ITEM 2)
34 2 REQ'D
14
APPLY CONDUCTIVE ADHESIVE
48
LOCATE GASKET ON BOTTOM SURFACE OF ITEM 4 SEE DETAIL D
47
26 2 REQ'D
SEE NOTE 2
40 2 REQ'D
13
SEE NOTE 1
23 7 FINGERS LOCATE AT FRONT EDGE. APPROX. CENTERED ON TAB ON ITEM 4.
12
15
23 1 FINGER
3
38 OR 5
7
25 4 REQ'D
29 2 REQ'D
33 2 REQ'D
26 2 REQ'D
30
50 SEE NOTE 3
41 11
SEE DETAIL "C"
16 APPLY ADHESIVE LOCTITE 411
22
27
6
8
9
39 2 REQ'D

NOTES:
1) WHEN SHIELD (ITEM 4) IS INSTALLED THE TAB WITH THE SHIELDING FINGERS (ITEM 23) SHOULD TUCK INTO THE FRONT PANEL ASSY (ITEM 6) AND BE IN CONTACT WITH THE BOTTOM OF THE BRACKET (ITEM 15).
2) DISCARD STRIP HEADER WHEN INSTALLING ITEM 12.
3) PTB APPROVAL LABEL (ITEM 50) MUST BE PLACED IN FRONT OF TEMP CONNECTOR.

**2 of 2**


2
35 2 PLACES
36 2 PLACES
37 2 PLACES

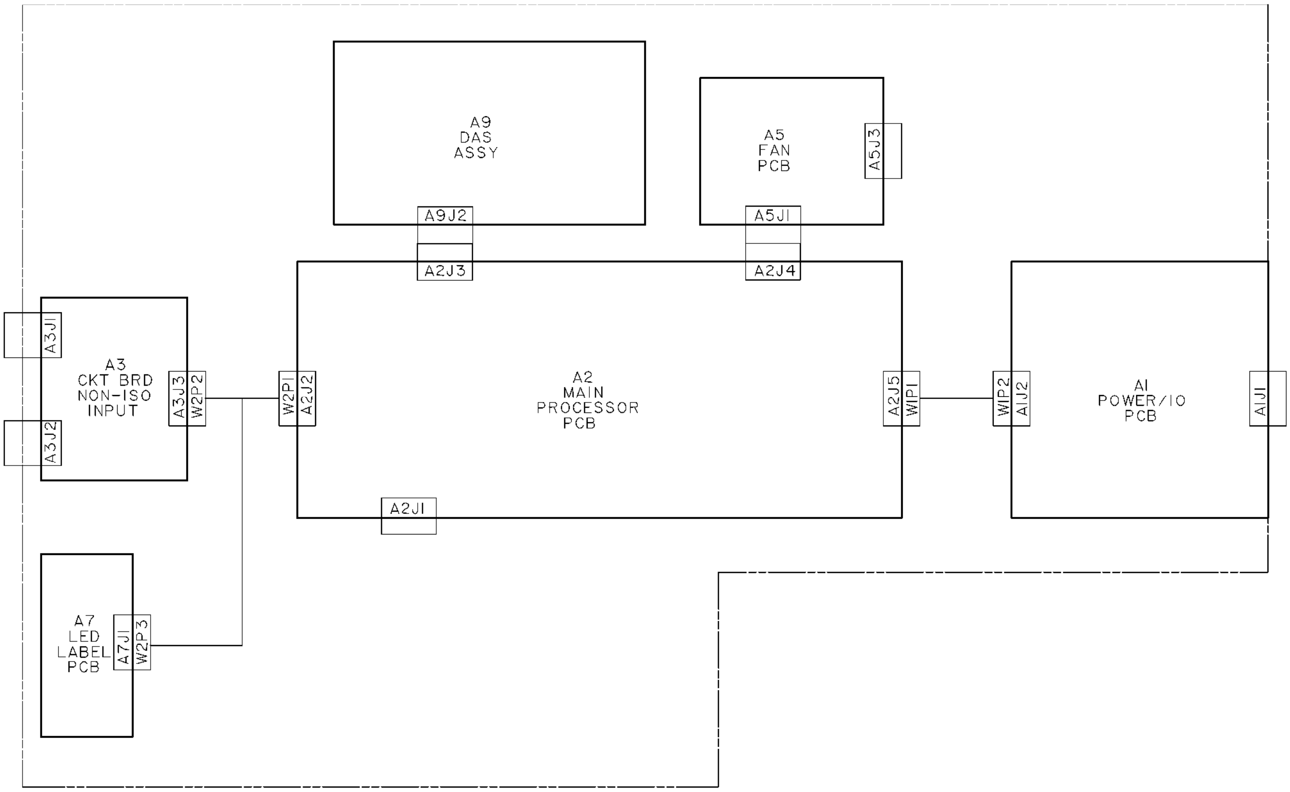
DETAIL B


46 2 PLACES
45 2 PLACES
44 2 PLACES
43

DETAIL C

# Schematic Diagram PN 408003C

1 of 2


A9
DAS
ASSY
A9J2
A5
FAN
PCB
A5J3
A5J1
A2J3
A2J4
A3J1
A3
CKT BRD
NON-ISO
INPUT
A3J3
W2P2
A3J2
W2P1
A2J2
A2
MAIN
PROCESSOR
PCB
A2J5
W1P1
W1P2
A1J2
A1
POWER/IO
PCB
A1J1
A2J1
A7
LED
LABEL
PCB
A7J1
W2P3

| | |
|---|---|
| DLK TXD+ | 1 |
| DLK TXD- | 2 |
| DLK RXD+ | 3 |
| DLK RXD- | 4 |
| PWRRTN | 5 |
| SENSE OUT | 6 |
| +16 5V | 7 |
| PWRBUS | 8 |
| SHIELD | |

A3J1

| | |
|---|---|
| DEFIB SYNC ECG | 1 |
| GND | 2 |
| MARKER OUT | 3 |
| MARKER IN | 4 |
| AGND | 5 |
| ARTERIAL BP | 6 |
| SHIELD | |

A3J2

| | |
|---|---|
| PWRBUS | 1 |
| PWRRTN | 2 |
| PWRBUS | 3 |
| PWRRTN | 4 |
| NIBP P7 | 5 |
| NC | 6 |
| NIBP P6 | 7 |
| +12V SW | 8 |
| NIBP P5 | 9 |
| +12V SW | 10 |
| NIBP P4 | 11 |
| NC | 12 |
| NIBP P3 | 13 |
| NIBP ENBL* | 14 |
| NIBP P2 | 15 |
| NIBP IO* | 16 |
| NIBP P1 | 17 |
| NIBP RD* | 18 |
| NIBP P0 | 19 |
| NIBP WR* | 20 |
| NIBP SEL0 | 21 |
| NIBP SEL1 | 22 |
| GND | 23 |
| +5V | 24 |

A5J3

**2 of 2**

| Signal | A1J1 |
|---|---|
| AGND | A1 |
| XMIT EN* | A2 |
| SYNC ECG RTN | A3 |
| SYNC ECG(10MV/V) | A4 |
| MOD DATA CLK* | A5 |
| MOD DATA IN | A6 |
| MOD DATA OUT | A7 |
| MOD DATA LCH* | A8 |
| BP3 | A9 |
| NC | A10 |
| GND | A11 |
| BKPLANE ID | A12 |
| NC | A13 |
| NC | A14 |
| AGND | A15 |
| ART BP | B1 |
| MOD ENABLE | B2 |
| BP2 | B3 |
| +16 5V | B4 |
| PWRBUS | B5 |
| TRC2/ECGI | B6 |
| TRC1/ECGII | B7 |
| RESP/ECGV | B8 |
| NC | B9 |
| BP4 | B10 |
| GND | B11 |
| +5V | B12 |
| NC | B13 |
| NC | B14 |
| AGND | B15 |

| A2J5 (W1P1) | Signal | A1J2 (W1P2) |
|---|---|---|
| 1 | ART BP | 1 |
| 2 | SYNC ECG RTN | 2 |
| 3 | BP2 | 3 |
| 4 | SYNC ECG(10MV/V) | 4 |
| 5 | BP3 | 5 |
| 6 | BP4 | 6 |
| 7 | TRC2/ECGI | 7 |
| 8 | TRC1/ECGII | 8 |
| 9 | RESP/ECGV | 9 |
| 10 | NC | 10 |
| 11 | NC | 11 |
| 12 | AGND | 12 |
| 13 | -12 8 ANALOG | 13 |
| 14 | AGND | 14 |
| 15 | +12 8 ANALOG | 15 |
| 16 | +5 0 ANALOG | 16 |
| 17 | 5 0 RTN | 17 |
| 18 | -5 0 ANALOG | 18 |
| 19 | 5 0 RTN | 19 |
| 20 | XMIT EN* | 20 |
| 21 | MOD ENABLE | 21 |
| 22 | MOD DATA CLK* | 22 |
| 23 | MOD DATA IN | 23 |
| 24 | GND | 24 |
| 25 | MOD DATA OUT | 25 |
| 26 | GND | 26 |
| 27 | MOD DATA LCH* | 27 |
| 28 | BKPLANE ID | 28 |
| 29 | +5V | 29 |
| 30 | +5V BOOT | 30 |
| 31 | +5V | 31 |
| 32 | NC | 32 |
| 33 | +15 5V | 33 |
| 34 | PWRRTN | 34 |
| 35 | PWRRTN | 35 |
| 36 | +16 5V | 36 |
| 37 | +16 5V | 37 |
| 38 | NC | 38 |
| 39 | PWRBUS | 39 |
| 40 | PWRBUS | 40 |

| A3J3 (W2P2) | Signal | A2J2 (W2P1) |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRBUS | 2 |
| 3 | +16 5V | 3 |
| 4 | +16 5V | 4 |
| 5 | PWRRTN | 5 |
| 6 | PWRRTN | 6 |
| 7 | DLK RXD+ | 7 |
| 8 | DLK RXD- | 8 |
| 9 | DLK TXD+ | 9 |
| 10 | DLK TXD- | 10 |
| 11 | DSYNC OUT | 11 |
| 12 | GND | 12 |
| 13 | MARKER RTN | 13 |
| 14 | GND | 14 |
| 15 | SENSE OUT NC | 15 |
| 16 | NC | 16 |
| 17 | DSYNC ECG | 17 |
| 18 | AGND | 18 |
| 19 | BUF ART BP | 19 |
| 20 | AGND | 20 |

| A7J1 (W2P3) | Signal | A2J2 (W2P1) |
|---|---|---|
| 1 | PWR LED | 21 |
| 2 | NC | 22 |
| 3 | NC | 23 |
| 4 | GND | 24 |

| A2J4 | Signal | A5J1 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRRTN | 2 |
| 3 | PWRBUS | 3 |
| 4 | PWRRTN | 4 |
| 5 | NIBP P7 | 5 |
| 6 | NC | 6 |
| 7 | NIBP P6 | 7 |
| 8 | +5V | 8 |
| 9 | NIBP P5 | 9 |
| 10 | GND | 10 |
| 11 | NIBP P4 | 11 |
| 12 | FAN ENBL* | 12 |
| 13 | NIBP P3 | 13 |
| 14 | NIBP ENBL* | 14 |
| 15 | NIBP P2 | 15 |
| 16 | NIBP IO* | 16 |
| 17 | NIBP P1 | 17 |
| 18 | NIBP RD* | 18 |
| 19 | NIBP P0 | 19 |
| 20 | NIBP WR* | 20 |
| 21 | NIBP SEL0 | 21 |
| 22 | NIBP SEL1 | 22 |

| A2J3 | Signal | A9J2 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRBUS | 2 |
| 3 | PWRRTN | 3 |
| 4 | PWRRTN | 4 |
| 5 | NC | 5 |
| 6 | NC | 6 |
| 7 | GND | 7 |
| 8 | DAS GTXD | 8 |
| 9 | GND | 9 |
| 10 | DAS GRXD | 10 |
| 11 | +5V | 11 |
| 12 | DAS GDEN* | 12 |
| 13 | +5V | 13 |
| 14 | DAS ENBL* | 14 |

| A4J1 | Signal | A2J1 |
|---|---|---|
| 1 | NC | 1 |
| 2 | NC | 2 |
| 3 | NC | 3 |
| 4 | GND | 4 |
| 5 | NC | 5 |
| 6 | GND | 6 |
| 7 | NC | 7 |
| 8 | GND | 8 |
| 9 | NC | 9 |
| 10 | NC | 10 |
| 11 | NC | 11 |
| 12 | GND | 12 |
| 13 | NC | 13 |
| 14 | NC | 14 |
| 15 | NC | 15 |
| 16 | NC | 16 |
| 17 | NC | 17 |
| 18 | NC | 18 |
| 19 | NC | 19 |
| 20 | NC | 20 |
| 21 | NC | 21 |
| 22 | GND | 22 |
| 23 | NC | 23 |
| 24 | GND | 24 |
| 25 | NC | 25 |
| 26 | GND | 26 |
| 27 | OPER/TEST* | 27 |
| 28 | PA7 | 28 |
| 29 | SLOW/FAST* | 29 |
| 30 | PA6 | 30 |
| 31 | GND | 31 |
| 32 | PA5 | 32 |
| 33 | GND | 33 |
| 34 | PA4 | 34 |
| 35 | PAR/LCD* | 35 |
| 36 | PA3 | 36 |
| 37 | GND | 37 |
| 38 | PA2 | 38 |
| 39 | GND | 39 |
| 40 | PA1 | 40 |
| 41 | MINX RESET* | 41 |
| 42 | PA0 | 42 |
| 43 | PULSE | 43 |
| 44 | OBF* | 44 |
| 45 | INT DET | 45 |
| 46 | ACK* | 46 |
| 47 | CALIB OK | 47 |
| 48 | IBF | 48 |
| 49 | NC | 49 |
| 50 | STB* | 50 |
| 51 | LQS | 51 |
| 52 | NC | 52 |
| 53 | NO PRB | 53 |
| 54 | RXD* | 54 |
| 55 | PRB OFF | 55 |
| 56 | NC | 56 |
| 57 | LO SAT | 57 |
| 58 | +5 0 ANALOG | 58 |
| 59 | 5 0 RTN | 59 |
| 60 | -5 0 ANALOG | 60 |
| 61 | +5V | 61 |
| 62 | +5V | 62 |
| 63 | GND | 63 |
| 64 | GND | 64 |

# Parts List PN 408003C

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 1 | | Cover, Module | 400895-001 | 1 |
| 2 | | Frame | 400982-001 | 1 |
| 3 | | Shield, Top | 401679-001 | 1 |
| 4 | | Shield, Bottom | 401679-002 | 1 |
| 5 | | 500/600 Acquisition Module, 5-Lead | 408133-001 | * |
| 6 | | Label, Leadwire Warming | 414097-001 | * |
| 7 | | Fan PCB | 403549-002 | 1 |
| 8 | | Trim, Rubber, Front Bezel | 404620-001 | 1 |
| 9 | | Mounting Strap, Trim | 404621-001 | 1 |
| 10 | | Power Supply PCB | 401309-002 | 1 |
| 11 | | Label, Isolated Connector Function, Tram 500A/ 600A, English | 402312-001 | * |
| 12 | | Module Processor PCB | 800210-001 | 1 |
| 13 | | Circuit Board/Bezel Mount | 404762-001 | 1 |
| 14 | | Bracket, Power Supply PCB | 406254-001 | 1 |
| 15 | | Plate, Chassis Ground, Bottom/Front | 402317-001 | 1 |
| 16 | | Adhesive, Loctite Prism 411 | 4851-082 | AR |
| 17 | | Plate, Chassis Ground, Rear | 404680-001 | 1 |
| 18 | | Label, Cover, English | 403439-001 | * |
| 19 | | Spring, Compression | 402315-001 | 2 |
| 20 | | Screw, Power Supply PCB Mounting, SST, 4-40 | 402214-001 | 4 |
| 21 | | Label, Model/Serial Number | 404525-006 | 1 |
| 22 | | Power Indicator PCB | 403170-009 | 1 |
| 23 | | Spring, Chassis Ground, Rear | 403741-001 | AR |
| 24 | | Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16 | 4505-406 | 6 |
| 25 | | Nut, Hex, 4-40 | 4521-304 | 4 |
| 26 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 45074-406 | 12 |
| 27 | | Label, Lower Bezel | 408162-003 | 1 |
| 29 | | Screw, 4-40 x 7/8 | 404069-001 | 2 |
| 30 | | Non-Isolated Input PCB | 401315-002 | 1 |
| 31 | | Label, 60-Hz | 70386-001 | * |
| 32 | | Label, 50-Hz | 70386-002 | * |
| 33 | | Screw, BDGH, Phillips, 4-40 x 5/8 | 45074-420 | 2 |
| 34 | | Screw, BDGH, Phillips, 4-40 x 3/4 | 45074-424 | 4 |
| 35 | | Pin, Latch | 406037-001 | 2 |
| 36 | | Spring, Latch | 406019-001 | 2 |
| 37 | | Latch | 401682-001 | 2 |
| 38 | | 500/600 Acquisition Module, 10-Lead | 408133-002 | * |
| 39 | | Screw, BDGH, Phillips, 4-40 x 3/8 | 45074-412 | 2 |
| 40 | | Screw, BDGH, Phillips, 4-40 x 1-1/8 | 45074-436 | 2 |

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 41 | | Label, Isolated Connector Function, Tram 500A/ 600A, Icon | 402312-002 | * |
| 42 | | Label, Cover, Icon | 403439-002 | * |
| 43 | | Front Bezel, Lower | 401105-005 | 1 |
| 44 | | Pin, Latch | 402806-001 | 2 |
| 45 | | Spring, Flat, SST | 405041-001 | 2 |
| 46 | | Button, Latch | 402106-001 | 2 |
| 47 | | Gasket, Silver-Nickel | 407894-001 | 1 |
| 48 | | Adhesive, Conductive | 4851-088 | AR |
| 49 | | Screw, PNHD, 4-40 x 0.188 | 409009-001 | * |
| 50 | | Label PTB Approval | 409047-002 | * |

*See the following chart:

| | Assembly Configuration | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Item | -001 | -002 | -003 | -004 | -005 | -006 | -007 | -008 | -011 | -012 | -013 | -014 | -015 | -016 | -017 | -018 |
| 5 | 1 | 1 | – | – | 1 | 1 | – | – | 1 | 1 | – | – | 1 | 1 | – | – |
| 6 | 1 | – | 1 | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 11 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | – | – | – | – | – | – | – | – |
| 18 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | – | – | – | – | – | – | – | – |
| 31 | 1 | – | 1 | – | 1 | – | 1 | – | 1 | – | 1 | – | 1 | – | 1 | – |
| 38 | – | – | 1 | 1 | – | – | 1 | 1 | – | – | 1 | 1 | – | – | 1 | 1 |
| 41 | – | – | – | – | – | – | – | – | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 42 | – | – | – | – | – | – | – | – | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 49 | – | – | – | – | – | – | – | – | – | – | – | – | – | 1 | – | 1 |
| 50 | – | – | – | – | – | – | – | – | – | – | – | – | – | 1 | – | 1 |

# Assembly Revisions PN 408003

The baseline revision for this assembly is pn 408003C. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

**PN 408003A**

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 6 | | Label, Leadwires Warning | Not Used | 414097-001 | 1 |
| 49 | | Screw, BDGH, 4-40 x 0.188 | 45074-406 | 409009-001 | * |
| 50 | | Label, German PTB | Not Used | 409047-002 | 1 |

**PN 408003B**

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 6 | | Label, Leadwires Warning | Not Used | 414097-001 | 1 |

*For your notes*

# 13

# TRAM 600A/SL MODULE PN 408004/411163

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  Circuit Boards .......................................................... 13-2
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# General

## Circuit Boards

Details about the circuit boards contained in the Tram 600A/SL are discussed in later chapters arranged by part number.

**Table 13-1. Circuit Board Overview**

| Module Type | Upper Level | Leadwire Configuration | DAS Module | Acquisition Processor PCB | Module Processor PCB |
|---|---|---|---|---|---|
| Tram 600A | 408004-0XX | 5-Leadwire | 408133-002 | 800330-004 | 800210-005 |
| Tram 600SL | 411163-001A–H | 10-Leadwire | 411168-001 | 800330-004 | 800210-005 |
| Tram 600SL | 411163-001J | 10-Leadwire | 417122-001<br>(Replaced 411168-001) | 801040-001 | 800210-005 |

## Tram 600A Configurations

At the time of this writing, we make 16 configurations of the Tram 600A module. The differences between configurations are in the power frequency, the type of labelling, and the units of measure used. The table below lists the available configurations.

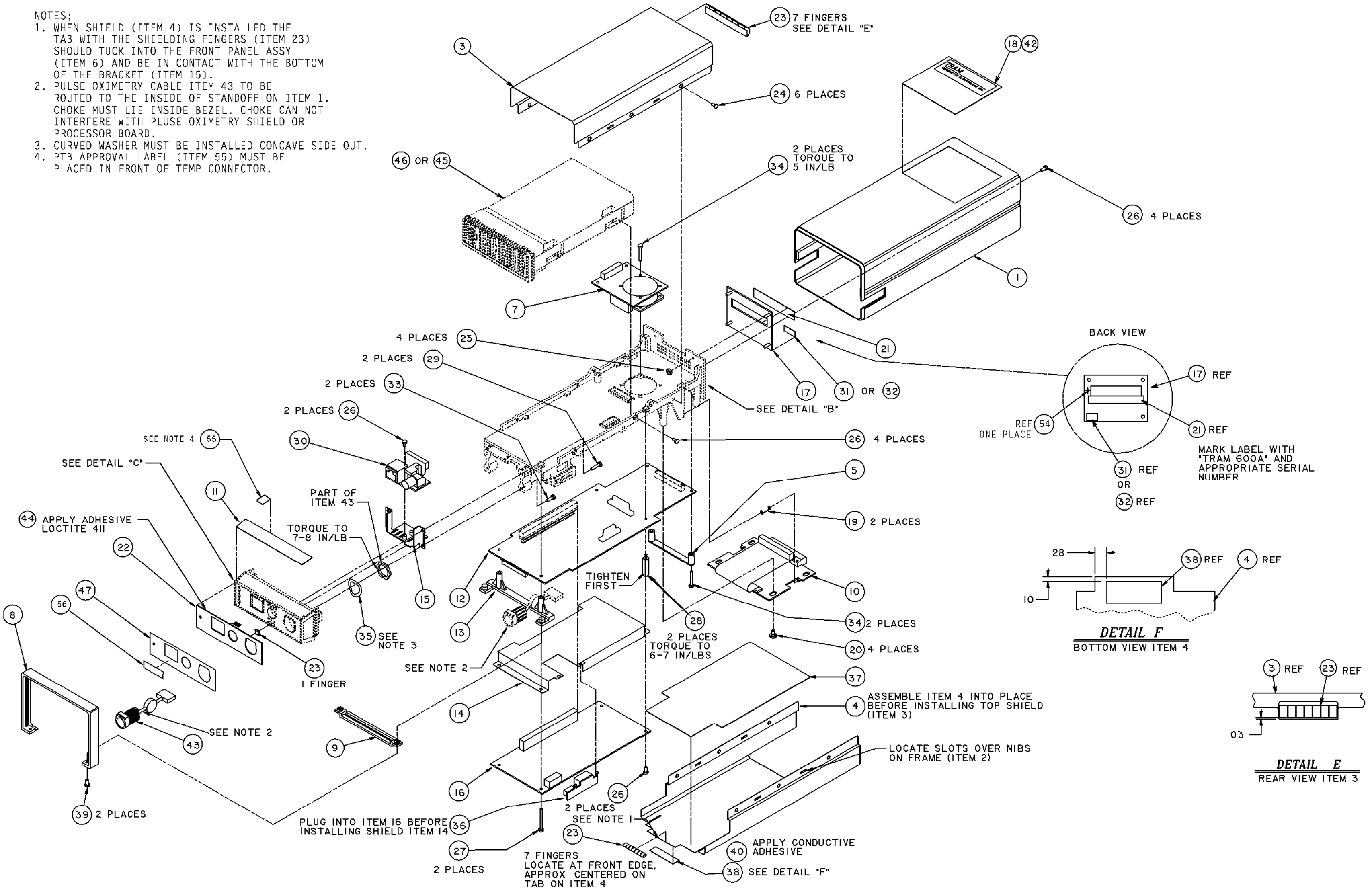
**Table 13-2. Configurations**

| Part Number | Rev | Power *f* (Hz) | Labels | Units of Measure |
|---|---|---|---|---|
| 408004-001 | B | 60 | English | English |
| 408004-002 | A | 50 | English | English |
| 408004-003 | B | 60 | English | English |
| 408004-004 | A | 50 | English | English |
| 408004-005 | A | 60 | English | SI |
| 408004-006 | A | 50 | English | SI |
| 408004-007 | A | 60 | English | SI |
| 408004-008 | A | 50 | English | SI |
| 408004-011 | A | 60 | Icon | English |
| 408004-012 | A | 50 | Icon | English |
| 408004-013 | A | 60 | Icon | English |
| 408004-014 | A | 50 | Icon | English |
| 408004-015 | A | 60 | Icon | SI |
| 408004-016 | B | 50 | Icon | SI |
| 408004-017 | A | 60 | Icon | SI |
| 408004-018 | B | 50 | Icon | SI |

Part number 408004A without a dashed suffix (ie, pn 408004A, as opposed to pn 408004-001A or pn 408004-002A) refers to all of the assemblies listed in the table above. Unless otherwise noted, all assemblies are the same.

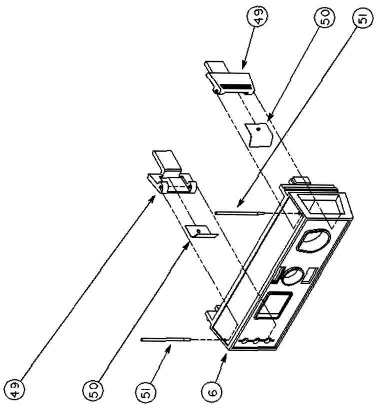
# Exploded View PN 408004C

1 of 2

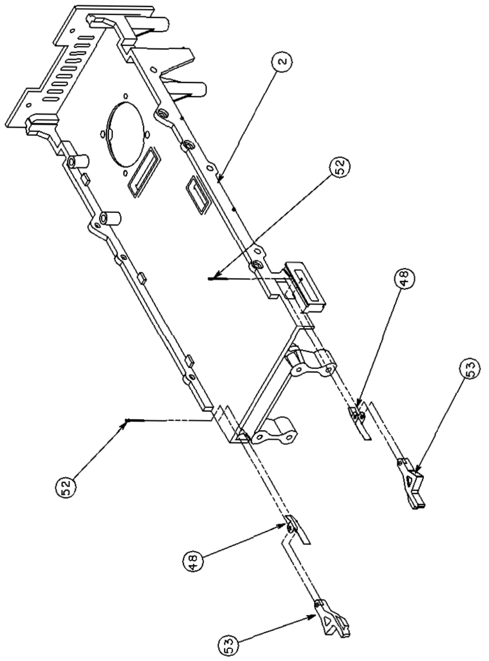

23 7 FINGERS SEE DETAIL "E"
18 42
3
24 6 PLACES
2 PLACES TORQUE TO 5 IN/LB 34
46 OR 45
26 4 PLACES
1
7
4 PLACES 25
2 PLACES 29
2 PLACES 33
2 PLACES 26
21
17
31 OR 32
SEE DETAIL "B"
BACK VIEW
17 REF
21 REF
REF 54 ONE PLACE
31 REF OR 32 REF
MARK LABEL WITH "TRAM 600A" AND APPROPRIATE SERIAL NUMBER
26 4 PLACES
SEE NOTE 4 55
30
SEE DETAIL "C"
11
PART OF ITEM 43
5
19 2 PLACES
44 APPLY ADHESIVE LOCTITE 411
TORQUE TO 7-8 IN/LB
22
47
56
8
15
12
TIGHTEN FIRST
10
28
2 PLACES TORQUE TO 6-7 IN/LBS
34 2 PLACES
20 4 PLACES
13
35 SEE NOTE 3
23 1 FINGER
SEE NOTE 2
14
37
4 ASSEMBLE ITEM 4 INTO PLACE BEFORE INSTALLING TOP SHIELD (ITEM 3)
SEE NOTE 2
43
9
16
26
LOCATE SLOTS OVER NIBS ON FRAME (ITEM 2)
39 2 PLACES
PLUG INTO ITEM 16 BEFORE INSTALLING SHIELD ITEM 14 36
2 PLACES SEE NOTE 1
23
27
2 PLACES
7 FINGERS LOCATE AT FRONT EDGE, APPROX CENTERED ON TAB ON ITEM 4
40 APPLY CONDUCTIVE ADHESIVE
38 SEE DETAIL "F"
28
10
38 REF
4 REF
DETAIL F
BOTTOM VIEW ITEM 4
3 REF
23 REF
03
DETAIL E
REAR VIEW ITEM 3

NOTES;
1. WHEN SHIELD (ITEM 4) IS INSTALLED THE TAB WITH THE SHIELDING FINGERS (ITEM 23) SHOULD TUCK INTO THE FRONT PANEL ASSY (ITEM 6) AND BE IN CONTACT WITH THE BOTTOM OF THE BRACKET (ITEM 15).
2. PULSE OXIMETRY CABLE ITEM 43 TO BE ROUTED TO THE INSIDE OF STANDOFF ON ITEM 1. CHOKE MUST LIE INSIDE BEZEL. CHOKE CAN NOT INTERFERE WITH PLUSE OXIMETRY SHIELD OR PROCESSOR BOARD.
3. CURVED WASHER MUST BE INSTALLED CONCAVE SIDE OUT.
4. PTB APPROVAL LABEL (ITEM 55) MUST BE PLACED IN FRONT OF TEMP CONNECTOR.

2 of 2


49
50
51
49
50
51
6

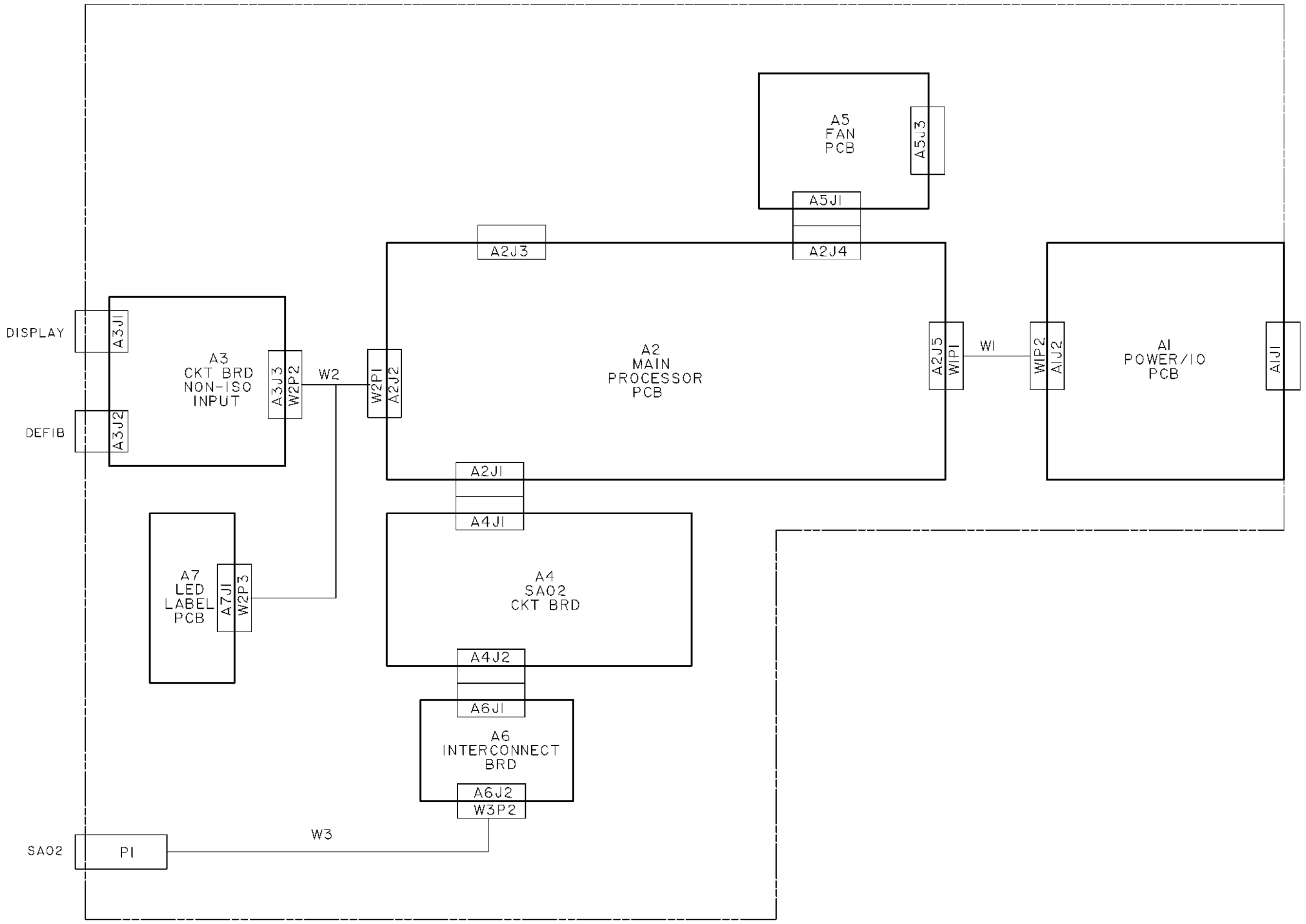
DETAIL C

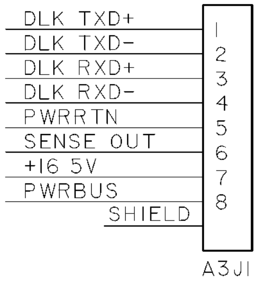

2
52
48
53
52
48
53

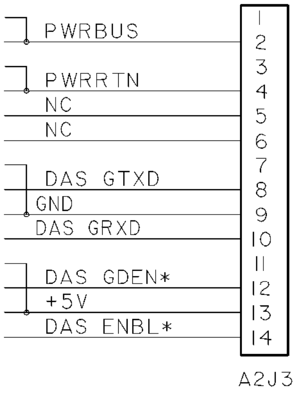
DETAIL B

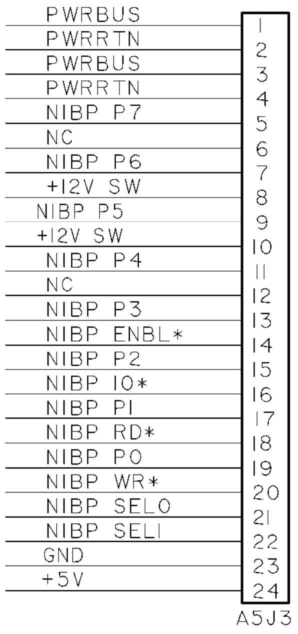
# Schematic Diagram PN 408004C

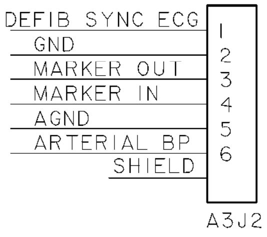
1 of 3


A5
FAN
PCB
A5J3
A5J1
A2J3
A2J4
DISPLAY
A3J1
A3
CKT BRD
NON-ISO
INPUT
A3J3
W2P2
W2
W2P1
A2J2
A2
MAIN
PROCESSOR
PCB
A2J5
W1P1
W1
W1P2
A1J2
A1
POWER/IO
PCB
A1J1
DEFIB
A3J2
A2J1
A4J1
A7
LED
LABEL
PCB
A7J1
W2P3
A4
SA02
CKT BRD
A4J2
A6J1
A6
INTERCONNECT
BRD
A6J2
W3P2
SA02
P1
W3

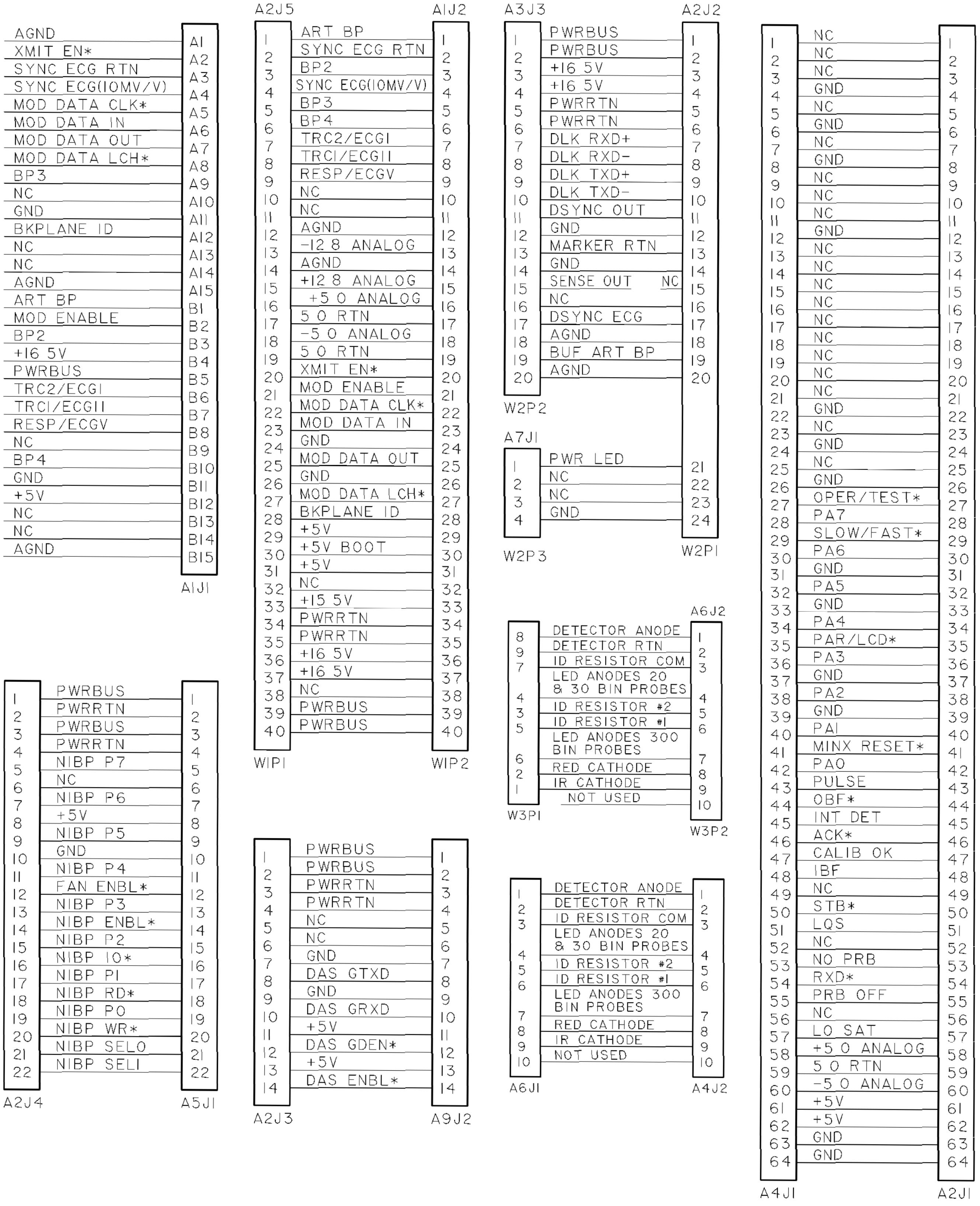

DLK TXD+
DLK TXD-
DLK RXD+
DLK RXD-
PWRRTN
SENSE OUT
+16 5V
PWRBUS
SHIELD
1
2
3
4
5
6
7
8
A3J1


PWRBUS
PWRRTN
NC
NC
DAS GTXD
GND
DAS GRXD
DAS GDEN*
+5V
DAS ENBL*
1
2
3
4
5
6
7
8
9
10
11
12
13
14
A2J3


PWRBUS
PWRRTN
PWRBUS
PWRRTN
NIBP P7
NC
NIBP P6
+12V SW
NIBP P5
+12V SW
NIBP P4
NC
NIBP P3
NIBP ENBL*
NIBP P2
NIBP IO*
NIBP P1
NIBP RD*
NIBP P0
NIBP WR*
NIBP SEL0
NIBP SEL1
GND
+5V
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
A5J3


DEFIB SYNC ECG
GND
MARKER OUT
MARKER IN
AGND
ARTERIAL BP
SHIELD
1
2
3
4
5
6
A3J2

**2 of 2**


A1J1
AGND A1
XMIT EN* A2
SYNC ECG RTN A3
SYNC ECG(10MV/V) A4
MOD DATA CLK* A5
MOD DATA IN A6
MOD DATA OUT A7
MOD DATA LCH* A8
BP3 A9
NC A10
GND A11
BKPLANE ID A12
NC A13
NC A14
AGND A15
ART BP B1
MOD ENABLE B2
BP2 B3
+16 5V B4
PWRBUS B5
TRC2/ECGI B6
TRC1/ECGII B7
RESP/ECGV B8
NC B9
BP4 B10
GND B11
+5V B12
NC B13
NC B14
AGND B15
A2J5 A1J2
1 ART BP 1
2 SYNC ECG RTN 2
3 BP2 3
4 SYNC ECG(10MV/V) 4
5 BP3 5
6 BP4 6
7 TRC2/ECGI 7
8 TRC1/ECGII 8
9 RESP/ECGV 9
10 NC 10
11 NC 11
12 AGND 12
13 -12 8 ANALOG 13
14 AGND 14
15 +12 8 ANALOG 15
16 +5 0 ANALOG 16
17 5 0 RTN 17
18 -5 0 ANALOG 18
19 5 0 RTN 19
20 XMIT EN* 20
21 MOD ENABLE 21
22 MOD DATA CLK* 22
23 MOD DATA IN 23
24 GND 24
25 MOD DATA OUT 25
26 GND 26
27 MOD DATA LCH* 27
28 BKPLANE ID 28
29 +5V 29
30 +5V BOOT 30
31 +5V 31
32 NC 32
33 +15 5V 33
34 PWRRTN 34
35 PWRRTN 35
36 +16 5V 36
37 +16 5V 37
38 NC 38
39 PWRBUS 39
40 PWRBUS 40
W1P1 W1P2
A3J3 A2J2
1 PWRBUS 1
2 PWRBUS 2
3 +16 5V 3
4 +16 5V 4
5 PWRRTN 5
6 PWRRTN 6
7 DLK RXD+ 7
8 DLK RXD- 8
9 DLK TXD+ 9
10 DLK TXD- 10
11 DSYNC OUT 11
12 GND 12
13 MARKER RTN 13
14 GND 14
15 SENSE OUT NC 15
16 NC 16
17 DSYNC ECG 17
18 AGND 18
19 BUF ART BP 19
20 AGND 20
W2P2
A7J1
1 PWR LED 21
2 NC 22
3 NC 23
4 GND 24
W2P3 W2P1
A6J2
8 DETECTOR ANODE 1
9 DETECTOR RTN 2
7 ID RESISTOR COM 3
LED ANODES 20
& 30 BIN PROBES
4 ID RESISTOR #2 4
3 ID RESISTOR #1 5
5 LED ANODES 300 6
BIN PROBES
6 RED CATHODE 7
2 IR CATHODE 8
1 NOT USED 9
10
W3P1 W3P2
1 DETECTOR ANODE 1
2 DETECTOR RTN 2
3 ID RESISTOR COM 3
LED ANODES 20
& 30 BIN PROBES
4 ID RESISTOR #2 4
5 ID RESISTOR #1 5
6 LED ANODES 300 6
BIN PROBES
7 RED CATHODE 7
8 IR CATHODE 8
9 NOT USED 9
10 10
A6J1 A4J2
1 PWRBUS 1
2 PWRRTN 2
3 PWRBUS 3
4 PWRRTN 4
5 NIBP P7 5
6 NC 6
7 NIBP P6 7
8 +5V 8
9 NIBP P5 9
10 GND 10
11 NIBP P4 11
12 FAN ENBL* 12
13 NIBP P3 13
14 NIBP ENBL* 14
15 NIBP P2 15
16 NIBP IO* 16
17 NIBP P1 17
18 NIBP RD* 18
19 NIBP P0 19
20 NIBP WR* 20
21 NIBP SEL0 21
22 NIBP SEL1 22
A2J4 A5J1
1 PWRBUS 1
2 PWRBUS 2
3 PWRRTN 3
4 PWRRTN 4
5 NC 5
6 NC 6
7 GND 7
8 DAS GTXD 8
9 GND 9
10 DAS GRXD 10
11 +5V 11
12 DAS GDEN* 12
13 +5V 13
14 DAS ENBL* 14
A2J3 A9J2
1 NC 1
2 NC 2
3 NC 3
4 GND 4
5 NC 5
6 GND 6
7 NC 7
8 GND 8
9 NC 9
10 NC 10
11 NC 11
12 GND 12
13 NC 13
14 NC 14
15 NC 15
16 NC 16
17 NC 17
18 NC 18
19 NC 19
20 NC 20
21 NC 21
22 GND 22
23 NC 23
24 GND 24
25 NC 25
26 GND 26
27 OPER/TEST* 27
28 PA7 28
29 SLOW/FAST* 29
30 PA6 30
31 GND 31
32 PA5 32
33 GND 33
34 PA4 34
35 PAR/LCD* 35
36 PA3 36
37 GND 37
38 PA2 38
39 GND 39
40 PA1 40
41 MINX RESET* 41
42 PA0 42
43 PULSE 43
44 OBF* 44
45 INT DET 45
46 ACK* 46
47 CALIB OK 47
48 IBF 48
49 NC 49
50 STB* 50
51 LQS 51
52 NC 52
53 NO PRB 53
54 RXD* 54
55 PRB OFF 55
56 NC 56
57 LO SAT 57
58 +5 0 ANALOG 58
59 5 0 RTN 59
60 -5 0 ANALOG 60
61 +5V 61
62 +5V 62
63 GND 63
64 GND 64
A4J1 A2J1

# Parts List PN 408004C

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 1 | | Cover, Module | 400895-001 | 1 |
| 2 | | Frame | 400982-001 | 1 |
| 3 | | Shield, Top | 401679-001 | 1 |
| 4 | | Shield, Bottom | 401679-002 | 1 |
| 5 | | Bracket, Power Supply PCB | 406254-001 | 1 |
| 6 | | Front Bezel, Lower | 401105-004 | 1 |
| 7 | | Fan PCB | 403549-002 | 1 |
| 8 | | Trim, Rubber, Front Bezel | 404620-001 | 1 |
| 9 | | Mounting Strap, Trim | 404621-001 | 1 |
| 10 | | Power Supply PCB | 401309-002 | 1 |
| 11 | | Label, Isolated Connector Function, Tram 500A/ 600A, English | 402312-001 | * |
| 12 | | Module Processor PCB | 800210-001 | 1 |
| 13 | | Circuit Board/Bezel Mount | 404762-001 | 1 |
| 14 | | Shield, Pulse Oximetry PCB | 401680-001 | 1 |
| 15 | | Plate, Chassis Ground, Bottom/Front | 402317-001 | 1 |
| 16 | | Pulse Oximetry PCB | 401189-001 | 1 |
| 17 | | Plate, Chassis Ground, Rear | 404680-001 | 1 |
| 18 | | Label, Cover, English | 403439-001 | * |
| 19 | | Spring, Compression | 402315-001 | 2 |
| 20 | | Screw, Power Supply PCB Mounting, SST, 4-40 | 402214-001 | 4 |
| 21 | | Label, Model/Serial Number | 404525-006 | 1 |
| 22 | | Power Indicator PCB | 403170-008 | 1 |
| 23 | | Spring, Chassis Ground, Rear | 403741-001 | AR |
| 24 | | Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16 | 4505-406 | 6 |
| 25 | | Nut, Hex, 4-40 | 4521-304 | 4 |
| 26 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 45074-406 | 12 |
| 27 | | Screw, BDGH, Phillips, 4-40 x 1-3/8 | 45074-438 | 2 |
| 28 | | Spacer, Male/Female, 4-40 x 0.875 | 4656-414 | 2 |
| 29 | | Screw, 4-40 x 7/8 | 404069-001 | 2 |
| 30 | | Non-Isolated Input PCB | 401315-002 | 1 |
| 31 | | Label, 60-Hz | 70386-001 | * |
| 32 | | Label, 50-Hz | 70386-002 | * |
| 33 | | Screw, BDGH, Phillips, 4-40 x 5/8 | 45074-420 | 2 |
| 34 | | Screw, BDGH, Phillips, 4-40 x 3/4 | 45074-424 | 4 |
| 35 | | Washer, Pulse Oximetry Connector | 4550-250 | 1 |
| 36 | | Interconnect PCB | 800006-001 | 1 |
| 37 | | Insulator, Bottom Shield | 404188-001 | 1 |
| 38 | | Gasket, Silver-Nickel | 407894-001 | 1 |
| 39 | | Screw, BDGH, Phillips, 4-40 x 3/8 | 45074-412 | 2 |
| 40 | | Adhesive, Conductive | 4851-088 | 1 |

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 41 | | Label, Isolated Connector Function, Tram 500A/ 600A, Icon | 402312-002 | * |
| 42 | | Label, Cover, Icon | 403439-002 | * |
| 43 | | Harness, Pulse Oximetry PCB-to-Connector | 700091-001 | 1 |
| 44 | | Adhesive, Loctite Prism 411 | 4851-082 | AR |
| 45 | | 500/600 Acquisition Module, 5-Lead | 408133-001 | * |
| 46 | | 500/600 Acquisition Module, 10-Lead | 408133-002 | * |
| 47 | | Label, Lower Bezel | 408162-004 | 1 |
| 48 | | Spring, Latch | 406019-001 | 2 |
| 49 | | Button, Latch | 402106-001 | 2 |
| 50 | | Spring, Flat, SST | 405041-001 | 2 |
| 51 | | Pin, Latch | 402806-001 | 2 |
| 52 | | Pin, Latch | 406037-001 | 2 |
| 53 | | Latch | 401682-001 | 2 |
| 54 | | Screw, PNHD, 4-40 x 0.188 | 409009-001 | * |
| 55 | | Label, PTB Approval | 409047-002 | * |
| 56 | | Label, PTB Approval | 414097-001 | * |

*See the following chart:

| | Assembly Configuration | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Item | -001 | -002 | -003 | -004 | -005 | -006 | -007 | -008 | -011 | -012 | -013 | -014 | -015 | -016 | -017 | -018 |
| 11 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | – | – | – | – | – | – | – | – |
| 18 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | – | – | – | – | – | – | – | – |
| 31 | 1 | – | 1 | – | 1 | – | 1 | – | 1 | – | 1 | – | 1 | – | 1 | – |
| 32 | – | 1 | – | 1 | – | 1 | – | 1 | – | 1 | – | 1 | – | 1 | – | 1 |
| 41 | – | – | – | – | – | – | – | – | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 42 | – | – | – | – | – | – | – | – | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 45 | 1 | 1 | – | – | 1 | 1 | – | – | 1 | 1 | – | – | 1 | 1 | – | – |
| 46 | – | – | 1 | 1 | – | – | 1 | 1 | – | – | 1 | 1 | – | – | 1 | 1 |
| 54 | – | – | – | – | – | – | – | – | – | – | – | – | – | 1 | – | 1 |
| 54 | – | – | – | – | – | – | – | – | – | – | – | – | – | 1 | – | 1 |
| 55 | 1 | – | 1 | – | – | – | – | – | – | – | – | – | – | – | – | – |

# Assembly Revisions PN 408004

The baseline revision for this assembly is pn 408004C. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

**PN 408004A**

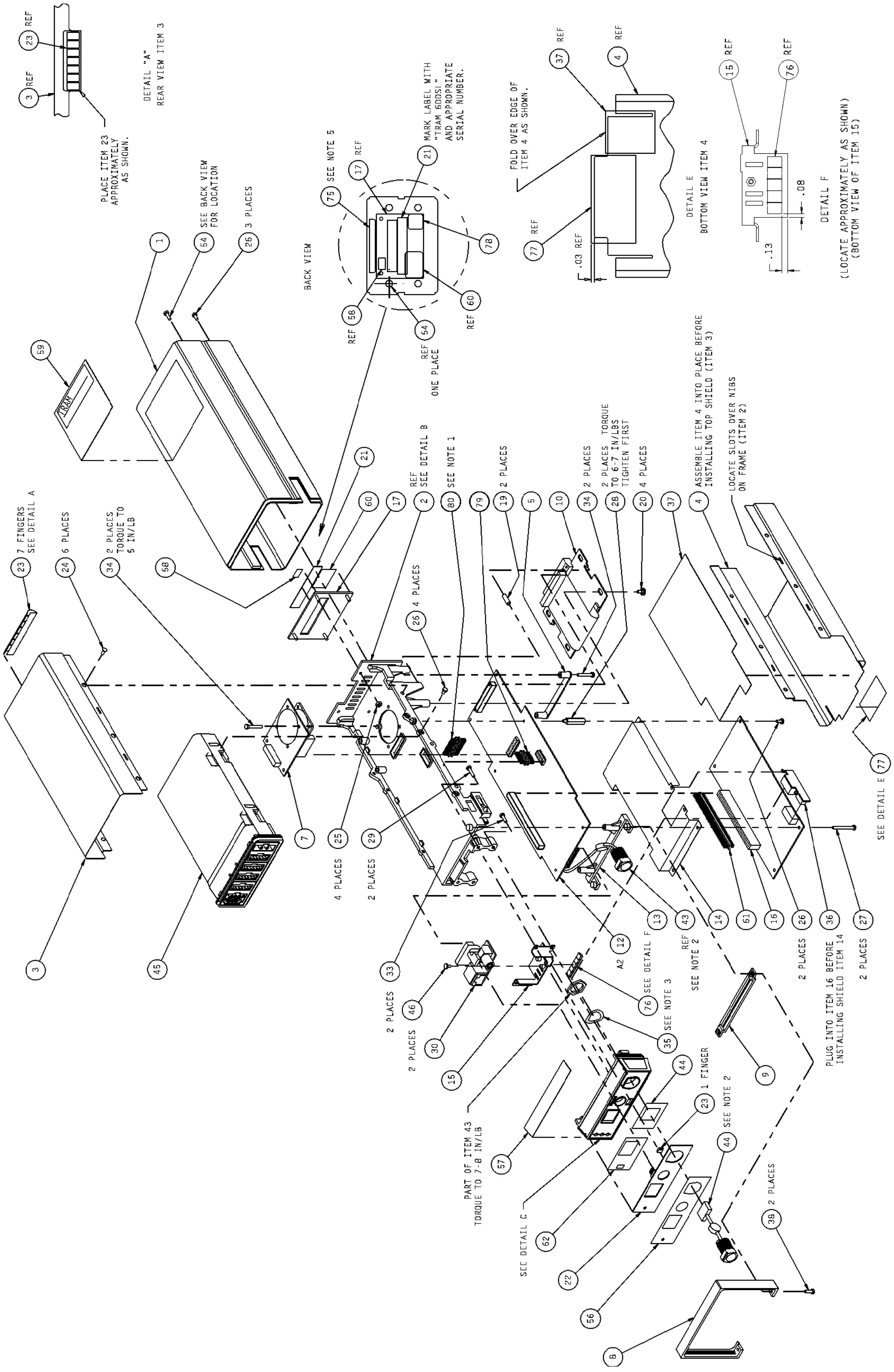
| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 54 | | Screw, BDGH, 4-40 x 0.188 | 45074-406 | 409009-001 | * |
| 55 | | Label, German PTB | Not Used | 409047-002 | 1 |
| 56 | | Label, Leadwires Warning | Not Used | 414097-001 | 1 |

**PN 408004B**

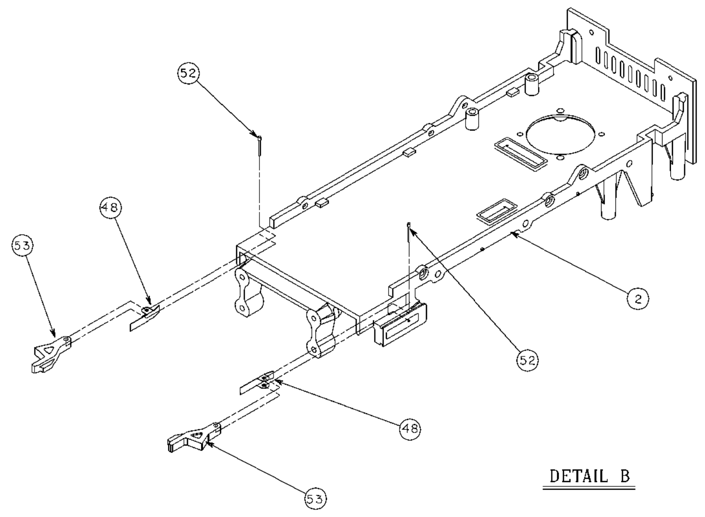
| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 56 | | Label, Leadwires Warning | Not Used | 414097-001 | 1 |

# Exploded View PN 411163-001J

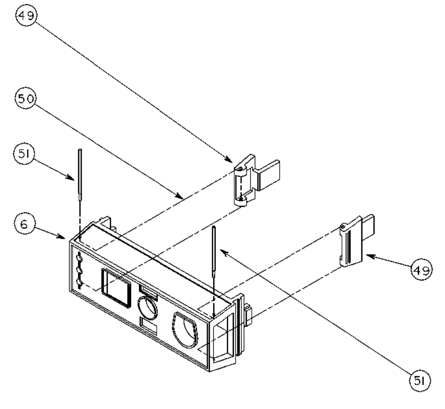
1 of 2


23 REF
3 REF
DETAIL "A"
REAR VIEW ITEM 3
PLACE ITEM 23 APPROXIMATELY AS SHOWN.
BACK VIEW
75 SEE NOTE 5
17 REF
21 MARK LABEL WITH "TRAM 600SL" AND APPROPRIATE SERIAL NUMBER.
78
60 REF
58 REF
54 REF ONE PLACE
37 REF
4 REF
FOLD OVER EDGE OF ITEM 4 AS SHOWN.
77 REF
.03 REF
DETAIL E
BOTTOM VIEW ITEM 4
15 REF
76 REF
.08
.13
DETAIL F
(LOCATE APPROXIMATELY AS SHOWN)
(BOTTOM VIEW OF ITEM 15)
1
54 SEE BACK VIEW FOR LOCATION
26 3 PLACES
59
TRAM
21
60
17
2 REF SEE DETAIL B
80 SEE NOTE 1
79
19 2 PLACES
5
10
34 2 PLACES
28 2 PLACES TORQUE TO 6-7 IN/LBS TIGHTEN FIRST
20 4 PLACES
37
4 ASSEMBLE ITEM 4 INTO PLACE BEFORE INSTALLING TOP SHIELD (ITEM 3)
LOCATE SLOTS OVER NIBS ON FRAME (ITEM 2)
23 7 FINGERS SEE DETAIL A
24 6 PLACES
34 2 PLACES TORQUE TO 5 IN/LB
58
26 4 PLACES
77 SEE DETAIL E
3
45
7
25 4 PLACES
29 2 PLACES
33
13
43
14
61
16
26 2 PLACES
36
27 2 PLACES
A2 12
76 SEE DETAIL F
REF SEE NOTE 2
PLUG INTO ITEM 16 BEFORE INSTALLING SHIELD ITEM 14
46 2 PLACES
30 2 PLACES
15
35 SEE NOTE 3
9
44
23 1 FINGER
44 SEE NOTE 2
PART OF ITEM 43 TORQUE TO 7-8 IN/LB
57
SEE DETAIL C
62
22
56
38 2 PLACES
8

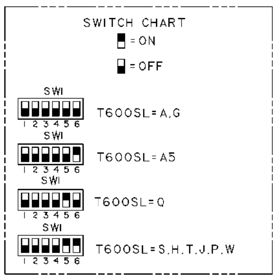
**2 of 2**

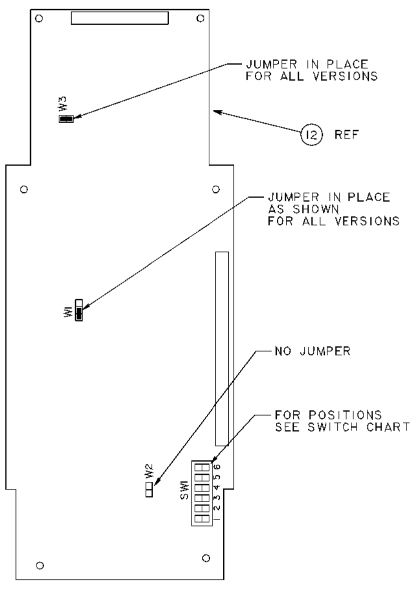

52
48
53
2
52
48
53

DETAIL B

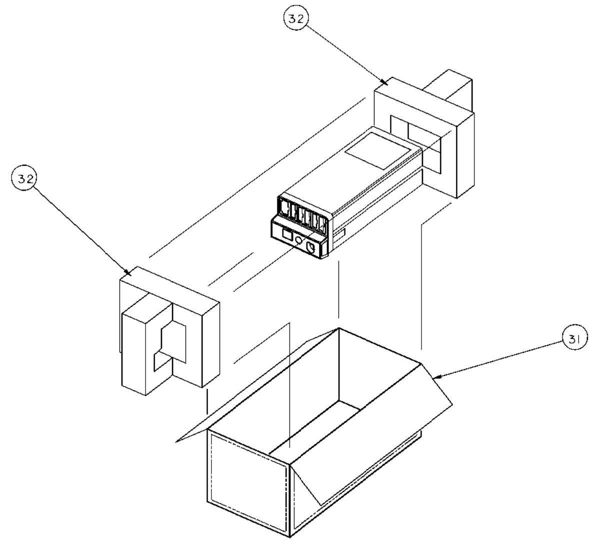

49
50
51
6
49
51

DETAIL C


SWITCH CHART
= ON
= OFF
SWI
1 2 3 4 5 6
T600SL=A,G
SWI
1 2 3 4 5 6
T600SL=A5
SWI
1 2 3 4 5 6
T600SL=Q
SWI
1 2 3 4 5 6
T600SL=S,H,T,J,P,W


JUMPER IN PLACE FOR ALL VERSIONS
W3
12 REF
JUMPER IN PLACE AS SHOWN FOR ALL VERSIONS
W1
NO JUMPER
W2
FOR POSITIONS SEE SWITCH CHART
SWI
1 2 3 4 5 6

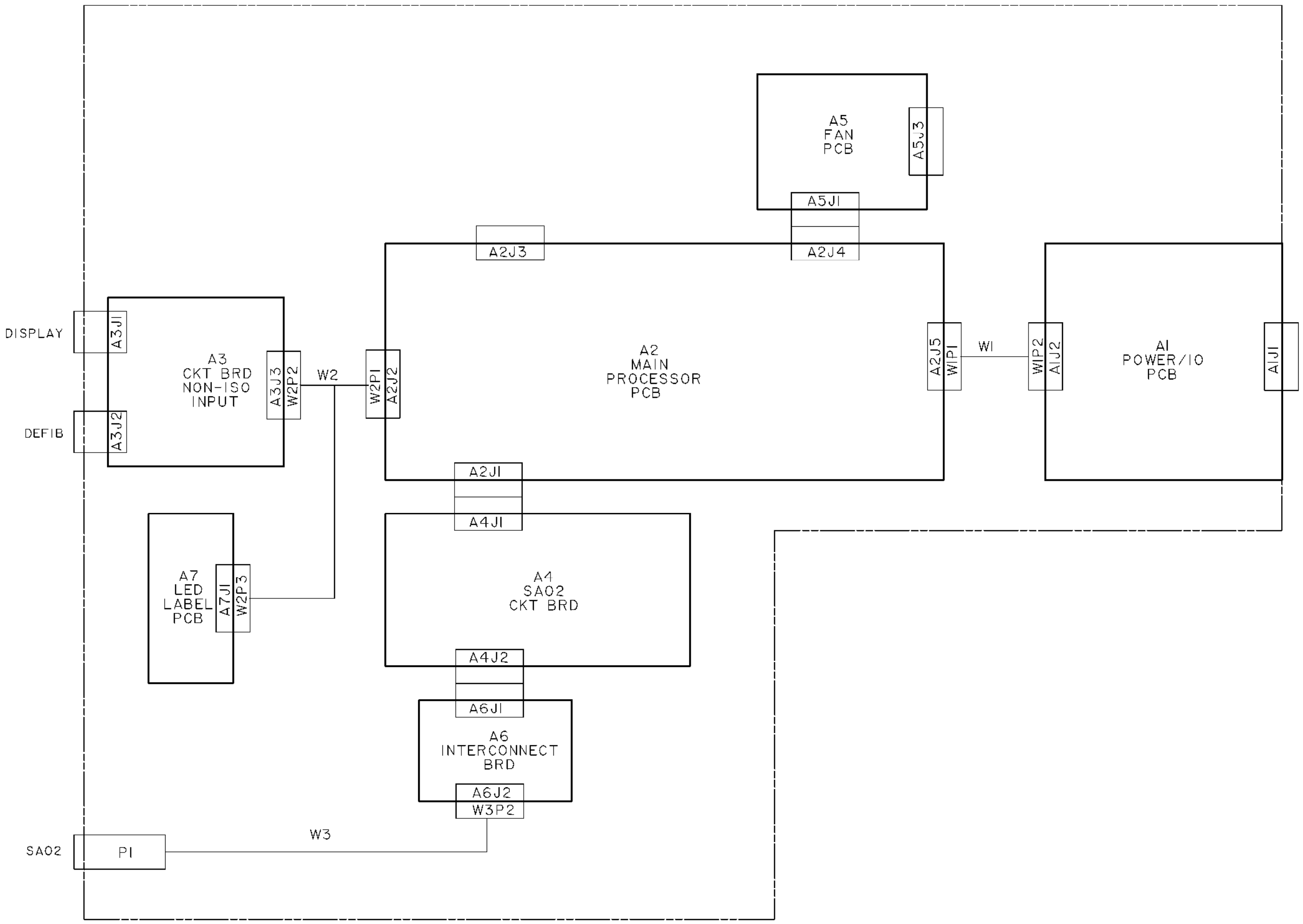
BOTTOM VIEW ITEM 12

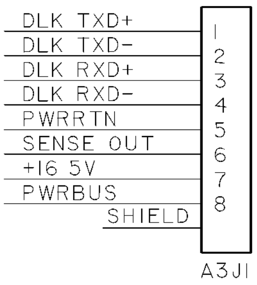


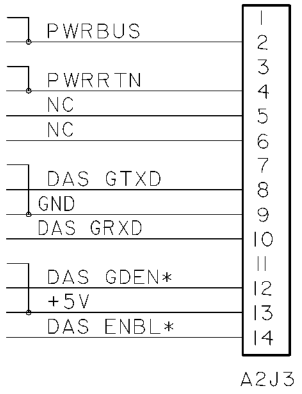
NOTES;
1. INSERT LONGER PIN SIDE INTO ITEM 12. PINS MUST EXTEND BEYOND MATING CONNECTOR ON ITEM 12 WHEN ASSEMBLED.
1. PULSE OXIMETRY CABLE ITEM 43 TO BE ROUTED TO THE INSIDE OF FIRST STANDOFF ON ITEM 13, THEN BEHIND NON-ISO INPUT PCB (ITEM 30) FLEX CIRCUIT CONNECTOR AND LASTLY TO THE INSIDE OF SECOND STANDOFF ON ITEM 13.
3. CURVED WASHER MUST BE INSTALLED CONCAVE SIDE OUT.
4. SWITCH SETTING MUST BE MADE FOR EACH CONFIGURATION. SEE PRODUCT LEVEL NOTE. (REFER TO SWITCH CHART)
5. MARK LABEL ITEM 75, AS FOLLOWS:
ZULASSUNGSKENNZEICHEN: 01/M-305/94.
6. CHECK APPROPRIATE BOX ON SIDE OF CARTON TO INDICATE UNIT BEING SHIPPED.
7. LOOSE ITEMS MAY BE SHIPPED WITH THE UNIT IF SPACE PERMITS OR PACKAGED AND SHIPPED SEPARATELY.

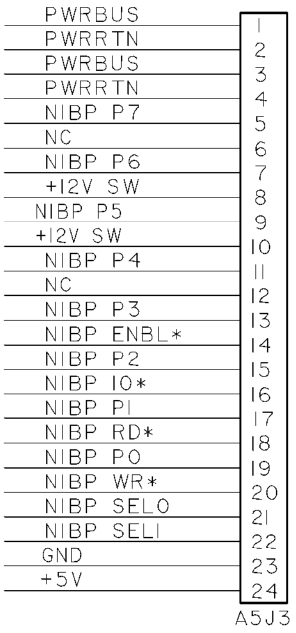
# Schematic Diagram PN 411163-001J

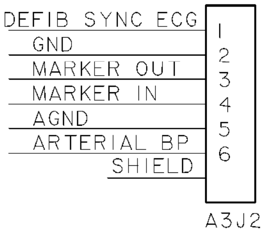
1 of 2


A5
FAN
PCB
A5J3
A5J1
A2J3
A2J4
DISPLAY
A3J1
A3
CKT BRD
NON-ISO
INPUT
A3J3
W2P2
W2
W2P1
A2J2
A2
MAIN
PROCESSOR
PCB
A2J5
W1P1
W1
W1P2
A1J2
A1
POWER/IO
PCB
A1J1
DEFIB
A3J2
A2J1
A4J1
A7
LED
LABEL
PCB
A7J1
W2P3
A4
SA02
CKT BRD
A4J2
A6J1
A6
INTERCONNECT
BRD
A6J2
W3P2
SA02
P1
W3

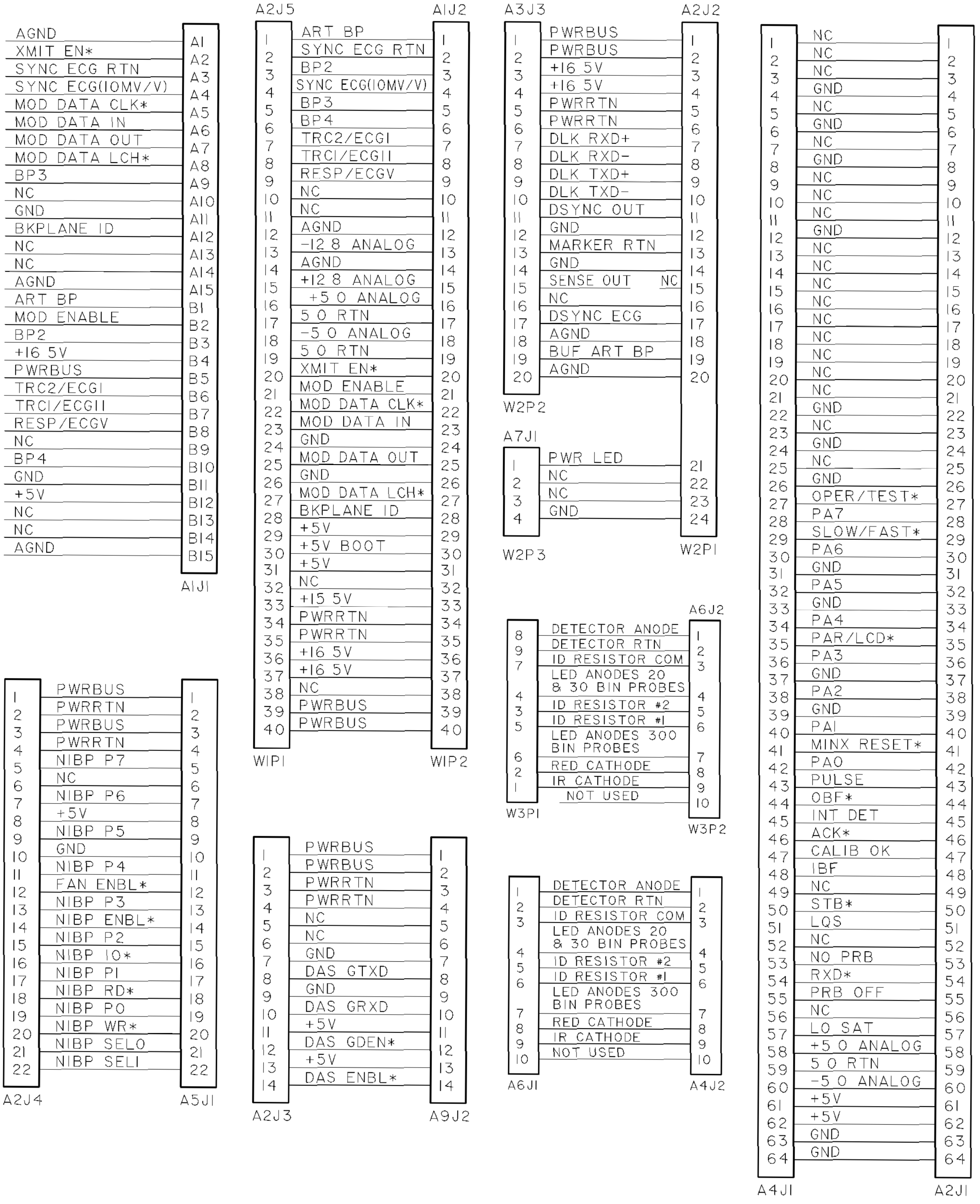

DLK TXD+
DLK TXD-
DLK RXD+
DLK RXD-
PWRRTN
SENSE OUT
+16.5V
PWRBUS
SHIELD
1
2
3
4
5
6
7
8
A3J1


PWRBUS
PWRRTN
NC
NC
DAS GTXD
GND
DAS GRXD
DAS GDEN*
+5V
DAS ENBL*
1
2
3
4
5
6
7
8
9
10
11
12
13
14
A2J3


PWRBUS
PWRRTN
PWRBUS
PWRRTN
NIBP P7
NC
NIBP P6
+12V SW
NIBP P5
+12V SW
NIBP P4
NC
NIBP P3
NIBP ENBL*
NIBP P2
NIBP IO*
NIBP P1
NIBP RD*
NIBP P0
NIBP WR*
NIBP SEL0
NIBP SEL1
GND
+5V
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
A5J3


DEFIB SYNC ECG
GND
MARKER OUT
MARKER IN
AGND
ARTERIAL BP
SHIELD
1
2
3
4
5
6
A3J2

**2 of 2**



| A1J1 | Signal |
|---|---|
| A1 | AGND |
| A2 | XMIT EN* |
| A3 | SYNC ECG RTN |
| A4 | SYNC ECG(10MV/V) |
| A5 | MOD DATA CLK* |
| A6 | MOD DATA IN |
| A7 | MOD DATA OUT |
| A8 | MOD DATA LCH* |
| A9 | BP3 |
| A10 | NC |
| A11 | GND |
| A12 | BKPLANE ID |
| A13 | NC |
| A14 | NC |
| A15 | AGND |
| B1 | ART BP |
| B2 | MOD ENABLE |
| B3 | BP2 |
| B4 | +16 5V |
| B5 | PWRBUS |
| B6 | TRC2/ECGI |
| B7 | TRC1/ECGII |
| B8 | RESP/ECGV |
| B9 | NC |
| B10 | BP4 |
| B11 | GND |
| B12 | +5V |
| B13 | NC |
| B14 | NC |
| B15 | AGND |

| A2J5 (W1P1) | Signal | A1J2 (W1P2) |
|---|---|---|
| 1 | ART BP | 1 |
| 2 | SYNC ECG RTN | 2 |
| 3 | BP2 | 3 |
| 4 | SYNC ECG(10MV/V) | 4 |
| 5 | BP3 | 5 |
| 6 | BP4 | 6 |
| 7 | TRC2/ECGI | 7 |
| 8 | TRC1/ECGII | 8 |
| 9 | RESP/ECGV | 9 |
| 10 | NC | 10 |
| 11 | NC | 11 |
| 12 | AGND | 12 |
| 13 | -12 8 ANALOG | 13 |
| 14 | AGND | 14 |
| 15 | +12 8 ANALOG | 15 |
| 16 | +5 0 ANALOG | 16 |
| 17 | 5 0 RTN | 17 |
| 18 | -5 0 ANALOG | 18 |
| 19 | 5 0 RTN | 19 |
| 20 | XMIT EN* | 20 |
| 21 | MOD ENABLE | 21 |
| 22 | MOD DATA CLK* | 22 |
| 23 | MOD DATA IN | 23 |
| 24 | GND | 24 |
| 25 | MOD DATA OUT | 25 |
| 26 | GND | 26 |
| 27 | MOD DATA LCH* | 27 |
| 28 | BKPLANE ID | 28 |
| 29 | +5V | 29 |
| 30 | +5V BOOT | 30 |
| 31 | +5V | 31 |
| 32 | NC | 32 |
| 33 | +15 5V | 33 |
| 34 | PWRRTN | 34 |
| 35 | PWRRTN | 35 |
| 36 | +16 5V | 36 |
| 37 | +16 5V | 37 |
| 38 | NC | 38 |
| 39 | PWRBUS | 39 |
| 40 | PWRBUS | 40 |

| A3J3 (W2P2) | Signal | A2J2 (W2P1) |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRBUS | 2 |
| 3 | +16 5V | 3 |
| 4 | +16 5V | 4 |
| 5 | PWRRTN | 5 |
| 6 | PWRRTN | 6 |
| 7 | DLK RXD+ | 7 |
| 8 | DLK RXD- | 8 |
| 9 | DLK TXD+ | 9 |
| 10 | DLK TXD- | 10 |
| 11 | DSYNC OUT | 11 |
| 12 | GND | 12 |
| 13 | MARKER RTN | 13 |
| 14 | GND | 14 |
| 15 | SENSE OUT NC | 15 |
| 16 | NC | 16 |
| 17 | DSYNC ECG | 17 |
| 18 | AGND | 18 |
| 19 | BUF ART BP | 19 |
| 20 | AGND | 20 |

| A7J1 (W2P3) | Signal | A2J2 (W2P1) |
|---|---|---|
| 1 | PWR LED | 21 |
| 2 | NC | 22 |
| 3 | NC | 23 |
| 4 | GND | 24 |

| W3P1 | Signal | A6J2 (W3P2) |
|---|---|---|
| 8 | DETECTOR ANODE | 1 |
| 9 | DETECTOR RTN | 2 |
| 7 | ID RESISTOR COM | 3 |
| 4 | LED ANODES 20 & 30 BIN PROBES | 4 |
| 3 | ID RESISTOR #2 | 5 |
| 5 | ID RESISTOR #1 | 6 |
| 6 | LED ANODES 300 BIN PROBES | 7 |
| 2 | RED CATHODE | 8 |
| 1 | IR CATHODE | 9 |
|  | NOT USED | 10 |

| A2J4 | Signal | A5J1 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRRTN | 2 |
| 3 | PWRBUS | 3 |
| 4 | PWRRTN | 4 |
| 5 | NIBP P7 | 5 |
| 6 | NC | 6 |
| 7 | NIBP P6 | 7 |
| 8 | +5V | 8 |
| 9 | NIBP P5 | 9 |
| 10 | GND | 10 |
| 11 | NIBP P4 | 11 |
| 12 | FAN ENBL* | 12 |
| 13 | NIBP P3 | 13 |
| 14 | NIBP ENBL* | 14 |
| 15 | NIBP P2 | 15 |
| 16 | NIBP IO* | 16 |
| 17 | NIBP P1 | 17 |
| 18 | NIBP RD* | 18 |
| 19 | NIBP P0 | 19 |
| 20 | NIBP WR* | 20 |
| 21 | NIBP SEL0 | 21 |
| 22 | NIBP SEL1 | 22 |

| A2J3 | Signal | A9J2 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRBUS | 2 |
| 3 | PWRRTN | 3 |
| 4 | PWRRTN | 4 |
| 5 | NC | 5 |
| 6 | NC | 6 |
| 7 | GND | 7 |
| 8 | DAS GTXD | 8 |
| 9 | GND | 9 |
| 10 | DAS GRXD | 10 |
| 11 | +5V | 11 |
| 12 | DAS GDEN* | 12 |
| 13 | +5V | 13 |
| 14 | DAS ENBL* | 14 |

| A6J1 | Signal | A4J2 |
|---|---|---|
| 1 | DETECTOR ANODE | 1 |
| 2 | DETECTOR RTN | 2 |
| 3 | ID RESISTOR COM | 3 |
|  | LED ANODES 20 & 30 BIN PROBES |  |
| 4 | ID RESISTOR #2 | 4 |
| 5 | ID RESISTOR #1 | 5 |
| 6 | LED ANODES 300 BIN PROBES | 6 |
| 7 | RED CATHODE | 7 |
| 8 | IR CATHODE | 8 |
| 9 | NOT USED | 9 |
| 10 |  | 10 |

| A4J1 | Signal | A2J1 |
|---|---|---|
| 1 | NC | 1 |
| 2 | NC | 2 |
| 3 | NC | 3 |
| 4 | GND | 4 |
| 5 | NC | 5 |
| 6 | GND | 6 |
| 7 | NC | 7 |
| 8 | GND | 8 |
| 9 | NC | 9 |
| 10 | NC | 10 |
| 11 | NC | 11 |
| 12 | GND | 12 |
| 13 | NC | 13 |
| 14 | NC | 14 |
| 15 | NC | 15 |
| 16 | NC | 16 |
| 17 | NC | 17 |
| 18 | NC | 18 |
| 19 | NC | 19 |
| 20 | NC | 20 |
| 21 | NC | 21 |
| 22 | GND | 22 |
| 23 | NC | 23 |
| 24 | GND | 24 |
| 25 | NC | 25 |
| 26 | GND | 26 |
| 27 | OPER/TEST* | 27 |
| 28 | PA7 | 28 |
| 29 | SLOW/FAST* | 29 |
| 30 | PA6 | 30 |
| 31 | GND | 31 |
| 32 | PA5 | 32 |
| 33 | GND | 33 |
| 34 | PA4 | 34 |
| 35 | PAR/LCD* | 35 |
| 36 | PA3 | 36 |
| 37 | GND | 37 |
| 38 | PA2 | 38 |
| 39 | GND | 39 |
| 40 | PA1 | 40 |
| 41 | MINX RESET* | 41 |
| 42 | PA0 | 42 |
| 43 | PULSE | 43 |
| 44 | OBF* | 44 |
| 45 | INT DET | 45 |
| 46 | ACK* | 46 |
| 47 | CALIB OK | 47 |
| 48 | IBF | 48 |
| 49 | NC | 49 |
| 50 | STB* | 50 |
| 51 | LQS | 51 |
| 52 | NC | 52 |
| 53 | NO PRB | 53 |
| 54 | RXD* | 54 |
| 55 | PRB OFF | 55 |
| 56 | NC | 56 |
| 57 | LO SAT | 57 |
| 58 | +5 0 ANALOG | 58 |
| 59 | 5 0 RTN | 59 |
| 60 | -5 0 ANALOG | 60 |
| 61 | +5V | 61 |
| 62 | +5V | 62 |
| 63 | GND | 63 |
| 64 | GND | 64 |

# Parts List PN 411163-001J

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 1 | | Cover, Module | 400895-001 | 1 |
| 2 | | Frame | 400982-001 | 1 |
| 3 | | Shield, Top | 401679-001 | 1 |
| 4 | | Shield, Bottom | 401679-002 | 1 |
| 5 | | Bracket, Power Supply PCB | 406254-001 | 1 |
| 6 | | Front Bezel, Lower | 401105-004 | 1 |
| 7 | A5 | Fan PCB | 403549-002 | 1 |
| 8 | | Trim, Rubber, Front Bezel | 404620-001 | 1 |
| 9 | | Mounting Strap, Trim | 404621-001 | 1 |
| 10 | A1 | Power Supply PCB | 401309-002 | 1 |
| 12 | A2 | Module Processor PCB | 800210-005 | 1 |
| 13 | | Circuit Board/Bezel Mount | 404762-001 | 1 |
| 14 | | Shield, Pulse Oximetry PCB | 401680-001 | 1 |
| 15 | | Plate, Chassis Ground, Bottom/Front | 402317-001 | 1 |
| 16 | A4 | Pulse Oximetry PCB | 401189-001 | 1 |
| 17 | | Plate, Chassis Ground, Rear | 404680-001 | 1 |
| 18 | | Tram 100 - 800 A & SL Modules Service Manual | 404422-065 | AR |
| 19 | | Spring, Compression | 402315-001 | 2 |
| 20 | | Screw, Power Supply PCB Mounting, SST, 4-40 | 402214-001 | 4 |
| 21 | | Label, Model/Serial Number | 404525-006 | 1 |
| 22 | A7 | Power Indicator PCB | 403170-008 | 1 |
| 23 | | Spring, Chassis Ground, Rear | 403741-001 | AR |
| 24 | | Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16 | 4505-406 | 6 |
| 25 | | Nut, Hex, 4-40 | 4521-304 | 4 |
| 26 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 45074-406 | 12 |
| 27 | | Screw, BDGH, Phillips, 4-40 x 1-3/8 | 45074-438 | 2 |
| 28 | | Spacer, Male/Female, 4-40 x 0.875 | 4656-414 | 2 |
| 29 | | Screw, 4-40 x 7/8 | 404069-001 | 2 |
| 30 | A3 | Non-Isolated Input PCB | 401315-002 | 1 |
| 31 | | Carton, Shipping | 404211-003 | 1 |
| 32 | | Foam Insert | 404211-004 | 2 |
| 33 | | Screw, BDGH, Phillips, 4-40 x 5/8 | 45074-420 | 2 |
| 34 | | Screw, BDGH, Phillips, 4-40 x 3/4 | 45074-424 | 4 |
| 35 | | Washer, Pulse Oximetry Connector | 4550-250 | 1 |
| 36 | A6 | Interconnect PCB | 800006-001 | 1 |
| 37 | | Insulator, Bottom Shield | 404188-001 | 1 |
| 39 | | Screw, BDGH, Phillips, 4-40 x 3/8 | 45074-412 | 2 |
| 43 | P1, W3 | Harness Assembly, $SpO_2$ – w/Choke | 700091-004 | 1 |
| 44 | | Adhesive, Diecut, Front Right | 415098-001 | 1 |
| 45 | A9 | 600 Acquisition Module | 417122-001 | 1 |
| 46 | | Screw, PNH, Phillips, SST, 4-40 x 3/16 | 4502-406 | 2 |

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 48 | | Spring, Latch | 406019-001 | 2 |
| 49 | | Button, Latch | 402106-001 | 1 |
| 51 | | Pin, Latch | 402806-001 | 2 |
| 52 | | Pin, Latch | 406037-001 | 2 |
| 53 | | Latch | 401682-001 | 1 |
| 54 | | Screw, PNH, 4-40 x 0.188, Modified (Determined by Destination) | 409009-001 | 1 |
| 54 | | Screw, BDGH, 4-40 x 0.188 (Determined by Destination) | 45075-406 | 1 |
| 56 | | Label, Front, 600SL, English (Determined by Destination) | 411175-002 | 1 |
| 56 | | Label, Front, 600SL, German (Determined by Destination) | 411175-003 | 1 |
| 56 | | Label, Front, 600SL, French (Determined by Destination) | 411175-004 | 1 |
| 56 | | Label, Front, 600SL, Swedish (Determined by Destination) | 411175-005 | 1 |
| 56 | | Label, Front, 600SL, Spanish (Determined by Destination) | 411175-006 | 1 |
| 56 | | Label, Front, 600SL, Italian (Determined by Destination) | 411175-007 | 1 |
| 57 | | Label, Top, English (Determined by Destination) | 411175-009 | 1 |
| 57 | | Label, Top, German (Determined by Destination) | 411175-010 | 1 |
| 57 | | Label, Top, French (Determined by Destination) | 411175-011 | 1 |
| 57 | | Label, Top, Swedish (Determined by Destination) | 411175-012 | 1 |
| 57 | | Label, Top, Spanish (Determined by Destination) | 411175-013 | 1 |
| 57 | | Label, Top, Italian (Determined by Destination) | 411175-014 | 1 |
| 59 | | Label, Cover, English (Determined by Destination) | 411175-016 | 1 |
| 59 | | Label, Cover, German (Determined by Destination) | 411175-020 | 1 |
| 59 | | Label, Cover, French (Determined by Destination) | 411175-021 | 1 |
| 59 | | Label, Cover, Swedish (Determined by Destination) | 411175-022 | 1 |
| 59 | | Label, Cover, Spanish (Determined by Destination) | 411175-023 | 1 |
| 59 | | Label, Cover, French (Determined by Destination) | 411175-024 | 1 |
| 59 | | Label, Cover, International (Determined by Destination) | 411173-025 | 1 |
| 60 | | Label, TUV (Determined by Destination) | 408103-003 | 1 |
| 60 | | Label, UL (Determined by Destination) | 408230-002 | 1 |
| 61 | P1 | Connector, Header, 64-Pin, w/Ferrites | 409203-001 | 1 |
| 62 | | Adhesive, Diecut, Front Left | 415098-002 | 1 |
| 76 | | Spring, Chassis Ground, Small | 414610-001 | AR |
| 77 | | Adhesive, Mylar | 415316-001 | 1 |
| 78 | | Label, CE Mark | 408230-008 | 1 |
| 79 | | PC Post, 2 x 7 | 412062-004 | 1 |
| 80 | | PC Post, 2 x 11 | 412062-005 | 1 |

# Assembly Revisions PN 411163

The baseline revision for this assembly is pn 411163-001H. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

## PN 411163-001B

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 11 | | Label Set, Tram 600SL | 411175-001 | Not Used | 1 |
| 12 | | Module Processor PCB | 800210-002 | 800210-005 | 1 |
| 44 | | Adhesive, Loctite Prism 411 | 4851-082 | 415098-001 | AR |
| 45 | A9 | DAS 600 Module, 10-Lead | 411168-001 | 417122-001 | 1 |
| 46 | | Screw, Phillips, STT, 4-40 x 3/16 | Not Used | 4502-406 | 2 |
| 61 | | Connector, Header 64-pin w/Ferrites | Not Used | 409203-001 | 1 |
| 62 | | Adhesive, Diecut Front Left | Not Used | 415098-002 | 1 |
| 76 | | Spring, Chassis Ground, Small | Not Used | 414610-001 | AR |
| 77 | | Adhesive, Mylar | Not Used | 415316-001 | 1 |
| 78 | | Label, CE Mark | Not Used | 408230-008 | 1 |
| 79 | | PC Post, 2 x 7 | Not Used | 412062-004 | 1 |
| 80 | | PC Post, 2 x 11 | Not Used | 412062-005 | 1 |

## PN 411163-001C

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 12 | | Module Processor PCB | 800210-002 | 800210-005 | 1 |
| 44 | | Adhesive, Loctite Prism 411 | 4851-082 | 415098-001 | AR |
| 45 | A9 | DAS 600 Module, 10-Lead | 411168-001 | 417122-001 | 1 |
| 62 | | Adhesive, Diecut Front Left | Not Used | 415098-002 | 1 |
| 76 | | Spring, Chassis Ground, Small | Not Used | 414610-001 | AR |
| 77 | | Adhesive, Mylar | Not Used | 415316-001 | 1 |
| 78 | | Label, CE Mark | Not Used | 408230-008 | 1 |
| 79 | | PC Post, 2 x 7 | Not Used | 412062-004 | 1 |
| 80 | | PC Post, 2 x 11 | Not Used | 412062-005 | 1 |

## PN 411163-001D

This revision was a documentation change that does not affect this manual.
Refer to pn 411163-001C for changes to the parts list.

## PN 411163-001E

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 12 | | Module Processor PCB | 800210-002 | 800210-005 | 1 |
| 45 | A9 | DAS 600 Module, 10-Lead | 411168-001 | 417122-001 | 1 |
| 76 | | Spring, Chassis Ground, Small | Not Used | 414610-001 | AR |
| 77 | | Adhesive, Mylar | Not Used | 415316-001 | 1 |
| 78 | | Label, CE Mark | Not Used | 408230-008 | 1 |
| 79 | | PC Post, 2 x 7 | Not Used | 412062-004 | 1 |
| 80 | | PC Post, 2 x 11 | Not Used | 412062-005 | 1 |

## PN 411163-001F

This revision was a documentation change that does not affect this manual.
Refer to pn 411163-001E for changes to the parts list.

## PN 411163-001G

This revision was a documentation change that does not affect this manual.
Refer to pn 411163-001E for changes to the parts list.

## PN 411163-001H

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 45 | A9 | DAS 600 Module, 10-Lead | 411168-001 | 417122-001 | 1 |

*For your notes*

# 14

# TRAM 650SL MODULE PN 412656

**General** .......................................................................... **14-2**
Circuit Boards........................................................................ 14-2

**Exploded View PN 412656-001H** ........................................ **14-3**

**Schematic Diagram PN 412656-001H** .................................... **14-5**

**Parts List PN 412656-001H** ................................................ **14-7**

**ssembly Revisions PN 412656**............................................ **14-9**

# General

## Circuit Boards

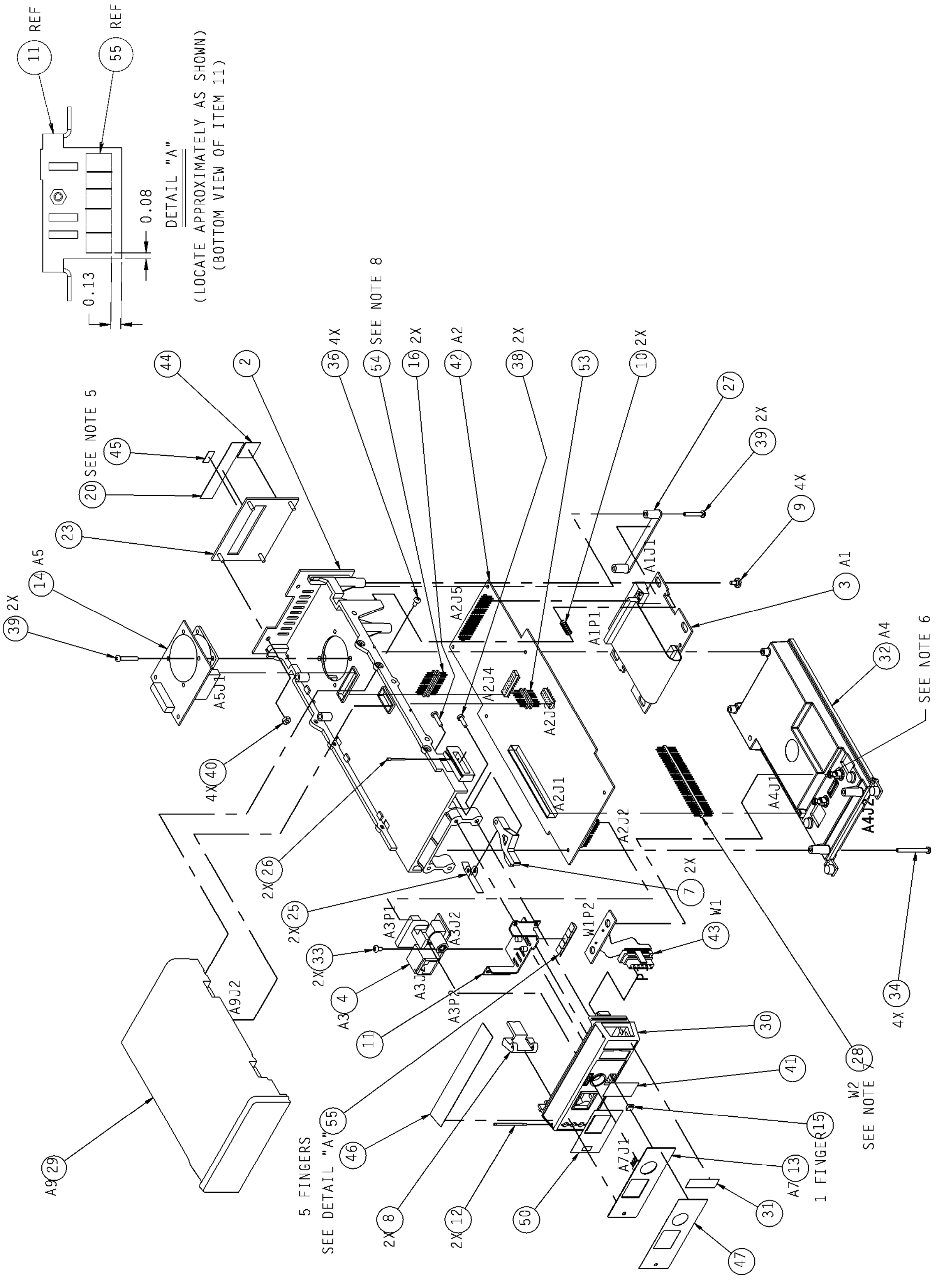
Details about the circuit boards contained in the Tram 650SL are discussed in later chapters arranged by part number.

**Table 14-1. Circuit Board Overview**

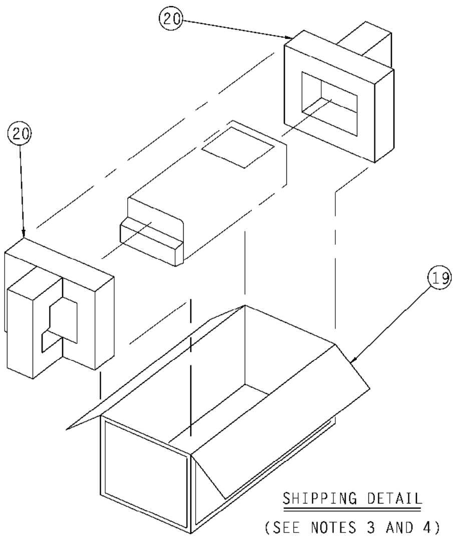
| Module Type | Upper Level | Leadwire Configuration | DAS Module | Acquisition Processor PCB | Module Processor PCB |
|---|---|---|---|---|---|
| Tram 650SL | 412656-001A-G | 10-Leadwire | 411168-001 | 800330-004 | 800210-005 |
| Tram 650SL | 412656-001H | 10-Leadwire | 417122-001<br>(Replaced 411168-001) | 801040-001 | 800210-005 |

# Exploded View PN 412656-001H

1 of 2

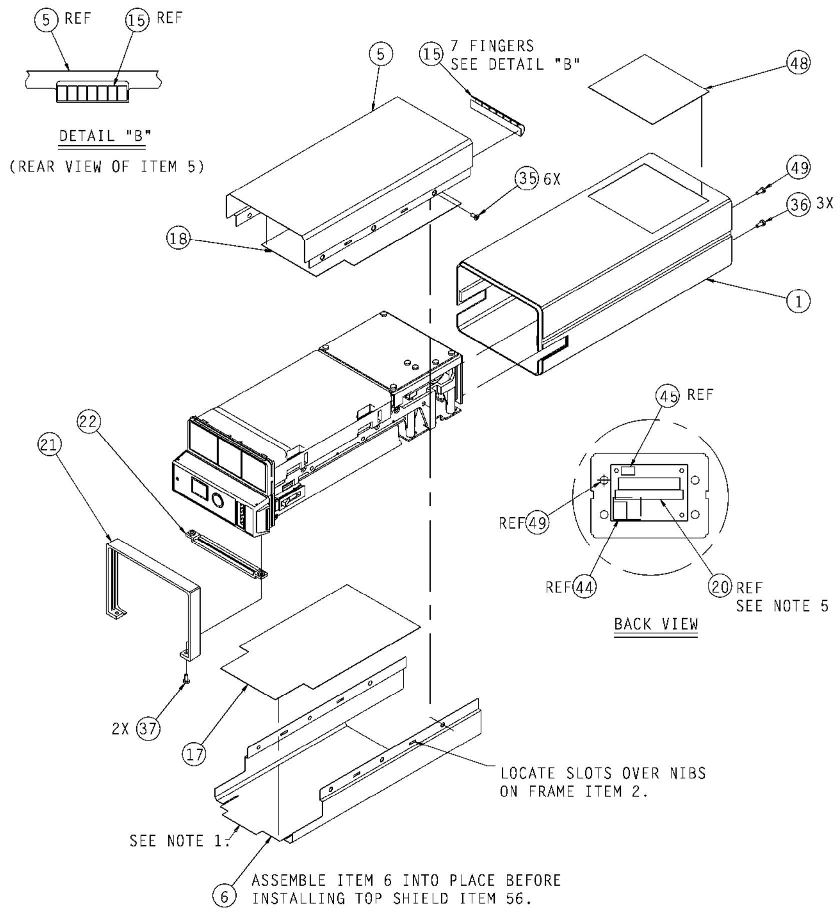

11 REF
55 REF
0.08
0.13
DETAIL "A"
(LOCATE APPROXIMATELY AS SHOWN)
(BOTTOM VIEW OF ITEM 11)
44
2
36 4X
54 SEE NOTE 8
16 2X
42 A2
38 2X
53
10 2X
27
39 2X
9 4X
A1J1
3 A1
32 A4
SEE NOTE 6
A4J1
A4J2
34 4X
28 W2 SEE NOTE 7
45 SEE NOTE 5
20
23
14 A5
39 2X
A5J1
40 4X
A2J5
A1P1
A2J4
A2J3
A2J1
A2J2
26 2X
25 2X
7 2X
43 W1
W1P2
P1
A3P1
A3J2
33 2X
4 A3
A3J1
A3P2
11
30
41
15
13 A7
1 FINGER
A7J1
31
47
50
12 2X
8 2X
46
55
5 FINGERS SEE DETAIL "A"
29 A9
A9J2

2 of 2



SHIPPING DETAIL

(SEE NOTES 3 AND 4)

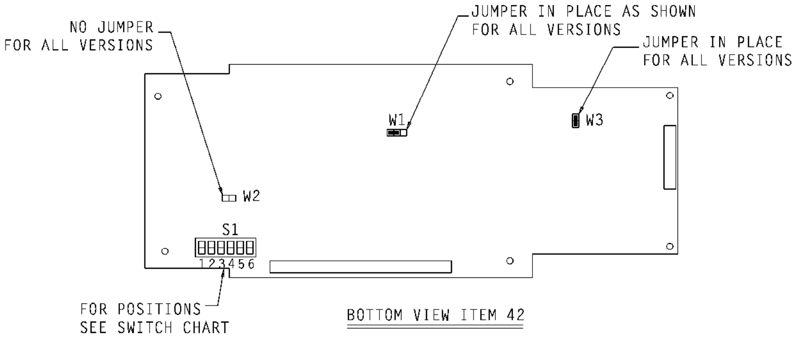

5 REF
15 REF
DETAIL "B"
(REAR VIEW OF ITEM 5)
5
15 7 FINGERS
SEE DETAIL "B"
48
35 6X
49
36 3X
18
1
45 REF
REF 49
REF 44
20 REF
SEE NOTE 5
BACK VIEW
22
21
2X 37
17
LOCATE SLOTS OVER NIBS
ON FRAME ITEM 2.
SEE NOTE 1.
6
ASSEMBLE ITEM 6 INTO PLACE BEFORE
INSTALLING TOP SHIELD ITEM 56.

SWITCH CHART

(SEE NOTE 2)

▮ =ON ▯ =OFF

| DESCRIPTION | SW1 1 | SW1 2 | SW1 3 | SW1 4 | SW1 5 | SW1 6 | OMAR NUMBER |
|---|---|---|---|---|---|---|---|
| ENG 60HZ | OFF | OFF | OFF | OFF | OFF | OFF | T650 =A,G |
| ENG 50HZ | OFF | OFF | OFF | OFF | OFF | ON | T650 =A5 |
| SI 60HZ | OFF | OFF | OFF | OFF | ON | OFF | T650 =Q |
| SI 50HZ | OFF | OFF | OFF | OFF | ON | ON | T650 =S,H,<br>T,J,<br>P,W |

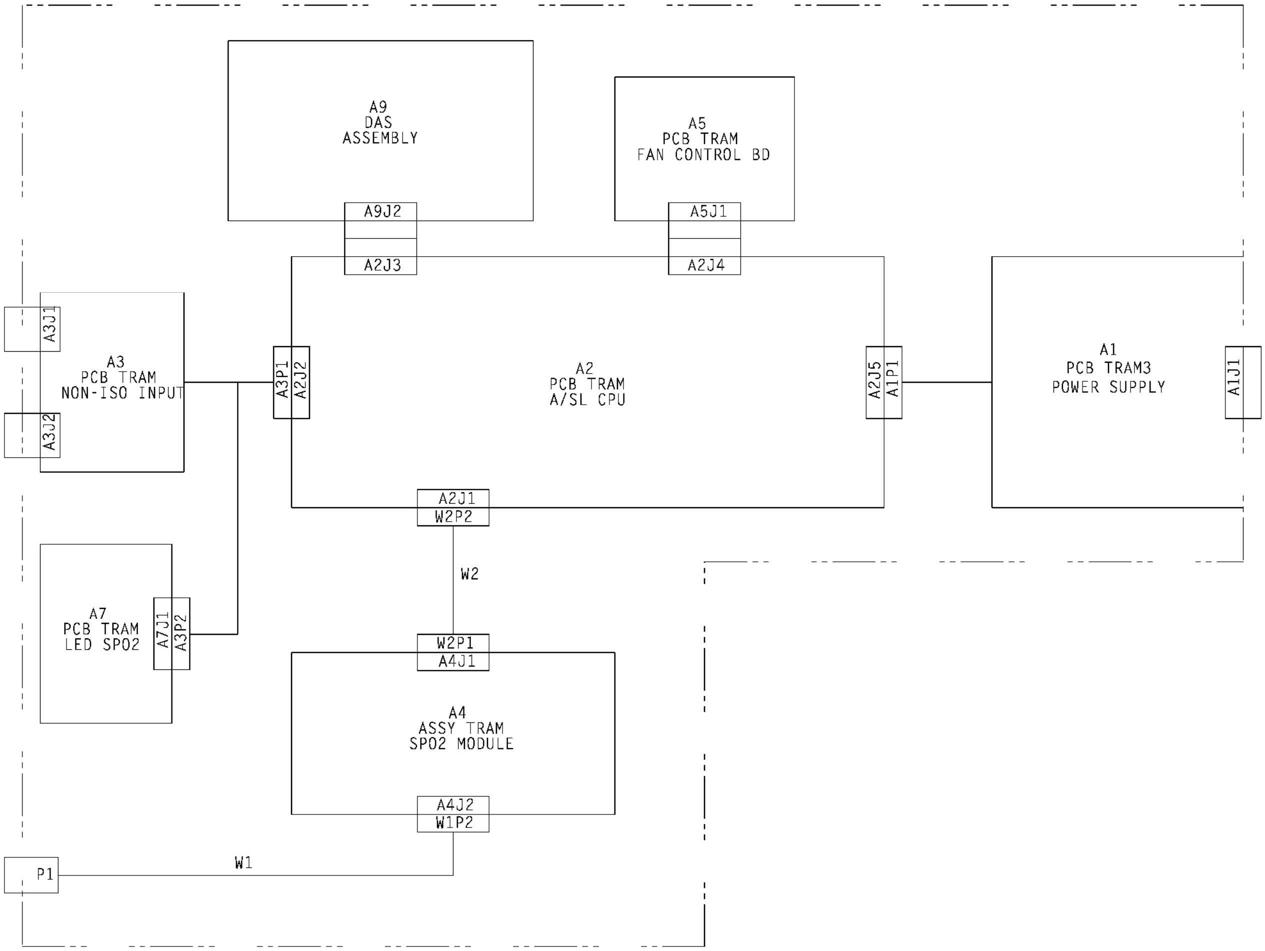

NO JUMPER
FOR ALL VERSIONS
JUMPER IN PLACE AS SHOWN
FOR ALL VERSIONS
JUMPER IN PLACE
FOR ALL VERSIONS
W1
W3
W2
S1
123456
FOR POSITIONS
SEE SWITCH CHART

BOTTOM VIEW ITEM 42

NOTES:
1. WHEN SHIELD (ITEM 6) IS INSTALLED, THE TAB SHOULD TUCK INTO THE FRONT BEZEL (ITEM 30) AND BE IN CONTACT WITH THE SHIELDING FINGERS (ITEM 15) ON THE BOTTOM OF THE BRACKET (ITEM 11).
2. SWITCH SETTINGS MUST BE MADE FOR EACH CONFIGURATION (SEE SWITCH CHART).
3. CHECK APPROPRIATE BOX ON SIDE OF CARTON TO INDICATE UNIT BEING SHIPPED.
4. LOOSE ITEMS MAY BE SHIPPED WITH THE UNIT IF SPACE PERMITS OR PACKAGED AND SHIPPED SEPARATELY.
5. MARK LABEL WITH "TRAM 650SL", SERIAL NUMBER, AND BAR CODE.
6. INSERT TWO HOLES OF FLEX PCB (ITEM 43) ONTO 1/4-TURN STANDOFF (ITEM 32) UNTIL CONNECTOR ON PCB FLEX BOTTOMS OUT. THEN LOCK THE STANDOFFS BY TURNING THE HEX SCREW OF THE STANDOFF 1/4-TURN CLOCKWISE.
7. INSERT THE SHORT LEADS OF CONNECTOR (ITEM 28) INTO PCB TRAM CPU (ITEM 42).
8. INSERT LONGER PIN SIDE INTO ITEM 52. PINS MUST EXTEND BEYOND MATING CONNECTOR ON ITEM 51 WHEN ASSEMBLED.

# Schematic Diagram PN 412656-001H

1 of 2


A9
DAS
ASSEMBLY
A9J2
A2J3
A5
PCB TRAM
FAN CONTROL BD
A5J1
A2J4
A3J1
A3
PCB TRAM
NON-ISO INPUT
A3J2
A3P1
A2J2
A2
PCB TRAM
A/SL CPU
A2J5
A1P1
A1
PCB TRAM3
POWER SUPPLY
A1J1
A2J1
W2P2
W2
W2P1
A4J1
A7
PCB TRAM
LED SPO2
A7J1
A3P2
A4
ASSY TRAM
SPO2 MODULE
A4J2
W1P2
P1
W1

| | |
|---|---|
| DLK TXD+ | 1 |
| DLK TXD- | 2 |
| DLK RXD+ | 3 |
| DLK RXD- | 4 |
| PWRRTN | 5 |
| SENSE OUT | 6 |
| +16 5V | 7 |
| PWRBUS | 8 |
| SHIELD | |

A3JI

| | |
|---|---|
| DEFIB SYNC ECG | 1 |
| GND | 2 |
| MARKER OUT | 3 |
| MARKER IN | 4 |
| AGND | 5 |
| ARTERIAL BP | 6 |
| SHIELD | |

A3J2

A4J2

| W1P2 | | P1 |
|---|---|---|
| 11 | RSENSE | 1 |
| 8 | RED_LED | 2 |
| 7 | IR_LED | 3 |
| 6 | LED_ANODES | 4 |
| 2 | POX+ | 5 |
| 1 | POX- | 9 |
| 13 | RSENSE COMMON | 7 |
| 15 | POX_ID* | 8 |
| 1 | POX- | 9 |
| 17 | OMEDA/NELLCOR* | 10 |
| 19 | FSHIELD | 11 |
| 4 | FSHIELD | 6 |
| 6 | FSHIELD | 6 |
| 8 | FSHIELD | 6 |
| 10 | FSHIELD | 6 |
| 12 | FSHIELD | 6 |
| 14 | FSHIELD | 6 |
| 16 | FSHIELD | 6 |
| 18 | FSHIELD | 6 |
| 20 | FSHIELD | 6 |

**2 of 2**

| | |
|---|---|
| AGND | A1 |
| XMIT EN* | A2 |
| SYNC ECG RTN | A3 |
| SYNC ECG(10MV/V) | A4 |
| MOD DATA CLK* | A5 |
| MOD DATA IN | A6 |
| MOD DATA OUT | A7 |
| MOD DATA LCH* | A8 |
| BP3 | A9 |
| NC | A10 |
| GND | A11 |
| BKPLANE ID | A12 |
| NC | A13 |
| NC | A14 |
| AGND | A15 |
| ART BP | B1 |
| MOD ENABLE | B2 |
| BP2 | B3 |
| +16 5V | B4 |
| PWRBU | B5 |
| TRC2/ECGI | B6 |
| TRC1/ECGII | B7 |
| RESP/ECGV | B8 |
| NC | B9 |
| BP4 | B10 |
| GND | B11 |
| +5V | B12 |
| NC | B13 |
| NC | B14 |
| AGND | B15 |
| | A1J1 |

| A2J5 | | A1J2 |
|---|---|---|
| 1 | ART BP | 1 |
| 2 | SYNC ECG RTN | 2 |
| 3 | BP2 | 3 |
| 4 | SYNC ECG(10MV/V) | 4 |
| 5 | BP3 | 5 |
| 6 | BP4 | 6 |
| 7 | TRC2/ECGI | 7 |
| 8 | TRC1/ECGII | 8 |
| 9 | RESP/ECGV | 9 |
| 10 | SPARE | 10 |
| 11 | SPARE | 11 |
| 12 | AGND | 12 |
| 13 | -12 8 ANALOG | 13 |
| 14 | AGND | 14 |
| 15 | +12 8 ANALOG | 15 |
| 16 | +5 0 ANALOG | 16 |
| 17 | 5 0 RTN | 17 |
| 18 | -5 0 ANALOG | 18 |
| 19 | 5 0 RTN | 19 |
| 20 | XMIT EN* | 20 |
| 21 | MOD ENABLE | 21 |
| 22 | MOD DATA CLK* | 22 |
| 23 | MOD DATA IN | 23 |
| 24 | GND | 24 |
| 25 | MOD DATA OUT | 25 |
| 26 | GND | 26 |
| 27 | MOD DATA LCH* | 27 |
| 28 | BKPLANE ID | 28 |
| 29 | +5V | 29 |
| 30 | +5V BOOT | 30 |
| 31 | +5V | 31 |
| 32 | SPARE | 32 |
| 33 | +15 5V | 33 |
| 34 | PWRRTN | 34 |
| 35 | PWRRTN | 35 |
| 36 | +16 5V | 36 |
| 37 | +16 5V | 37 |
| 38 | SPARE | 38 |
| 39 | PWRBUS | 39 |
| 40 | PWRBUS | 40 |
| A1P1 | | |

| A3J3 | | A2J2 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRBUS | 2 |
| 3 | +16 5V | 3 |
| 4 | +16 5V | 4 |
| 5 | PWRRTN | 5 |
| 6 | PWRRTN | 6 |
| 7 | DLK RXD+ | 7 |
| 8 | DLK RXD- | 8 |
| 9 | DLK TXD+ | 9 |
| 10 | DLK TXD- | 10 |
| 11 | DSYNC OUT | 11 |
| 12 | GND | 12 |
| 13 | MARKER RTN | 13 |
| 14 | GND | 14 |
| 15 | SPARE | 15 |
| 16 | SPARE | 16 |
| 17 | DSYNC ECG | 17 |
| 18 | AGND | 18 |
| 19 | BUF ART BP | 19 |
| 20 | AGND | 20 |
| W2P2 | | |
| A7J1 | | |
| 1 | PWR LED | 21 |
| 2 | SPARE | 22 |
| 3 | SPARE | 23 |
| 4 | GND | 24 |
| A3P1 | | W2P1 |

| A4J1 | | A2J1 |
|---|---|---|
| 1 | NC | 1 |
| 2 | NC | 2 |
| 3 | NC | 3 |
| 4 | GND | 4 |
| 5 | NC | 5 |
| 6 | GND | 6 |
| 7 | NC | 7 |
| 8 | GND | 8 |
| 9 | NC | 9 |
| 10 | NC | 10 |
| 11 | NC | 11 |
| 12 | GND | 12 |
| 13 | NC | 13 |
| 14 | NC | 14 |
| 15 | NC | 15 |
| 16 | NC | 16 |
| 17 | NC | 17 |
| 18 | NC | 18 |
| 19 | NC | 19 |
| 20 | NC | 20 |
| 21 | NC | 21 |
| 22 | GND | 22 |
| 23 | NC | 23 |
| 24 | GND | 24 |
| 25 | NC | 25 |
| 26 | GND | 26 |
| 27 | OPER/TEST* | 27 |
| 28 | PA7 | 28 |
| 29 | SLOW/FAST* | 29 |
| 30 | PA6 | 30 |
| 31 | GND | 31 |
| 32 | PA5 | 32 |
| 33 | GND | 33 |
| 34 | PA4 | 34 |
| 35 | PAR/LCD* | 35 |
| 36 | PA3 | 36 |
| 37 | GND | 37 |
| 38 | PA2 | 38 |
| 39 | GND | 39 |
| 40 | PA1 | 40 |
| 41 | MINX RESET* | 41 |
| 42 | PA0 | 42 |
| 43 | PULSE | 43 |
| 44 | OBF* | 44 |
| 45 | INT DET | 45 |
| 46 | ACK* | 46 |
| 47 | CALIB OK | 47 |
| 48 | IBF | 48 |
| 49 | SPARE | 49 |
| 50 | STB* | 50 |
| 51 | LQS | 51 |
| 52 | NC | 52 |
| 53 | NO PRB | 53 |
| 54 | RXD* | 54 |
| 55 | PRB OFF | 55 |
| 56 | NC | 56 |
| 57 | LO SAT | 57 |
| 58 | +5 0 ANALOG | 58 |
| 59 | 5 0 RTN | 59 |
| 60 | -5 0 ANALOG | 60 |
| 61 | +5V | 61 |
| 62 | +5V | 62 |
| 63 | GND | 63 |
| 64 | GND | 64 |
| W2P1 | | W2P2 |

| | | |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRRTN | 2 |
| 3 | PWRBUS | 3 |
| 4 | PWRRTN | 4 |
| 5 | NIBP P7 | 5 |
| 6 | SPARE | 6 |
| 7 | NIBP P6 | 7 |
| 8 | +5V | 8 |
| 9 | NIBP P5 | 9 |
| 10 | GND | 10 |
| 11 | NIBP P4 | 11 |
| 12 | FAN ENBL* | 12 |
| 13 | NIBP P3 | 13 |
| 14 | NIBP ENBL* | 14 |
| 15 | NIBP P2 | 15 |
| 16 | NIBP IO* | 16 |
| 17 | NIBP P1 | 17 |
| 18 | NIBP RD* | 18 |
| 19 | NIBP P0 | 19 |
| 20 | NIBP WR* | 20 |
| 21 | NIBP SEL0 | 21 |
| 22 | NIBP SEL1 | 22 |
| A2J4 | | A5J1 |

| | | |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRBUS | 2 |
| 3 | PWRRTN | 3 |
| 4 | PWRRTN | 4 |
| 5 | SPARE | 5 |
| 6 | SPARE | 6 |
| 7 | GND | 7 |
| 8 | DAS GTXD | 8 |
| 9 | GND | 9 |
| 10 | DAS GRXD | 10 |
| 11 | +5V | 11 |
| 12 | DAS GDEN* | 12 |
| 13 | +5V | 13 |
| 14 | DAS ENBL* | 14 |
| A9J2 | | A2J3 |

# Parts List PN 412656-001H

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 1 | | Cover, Module | 400895-001 | 1 |
| 2 | | Frame | 400982-001 | 1 |
| 3 | A1 | Power Supply PCB | 401309-002 | 1 |
| 4 | A3 | Non-Isolated Input PCB | 401315-002 | 1 |
| 5 | | Shield, Top | 401679-001 | 1 |
| 6 | | Shield, Bottom | 401679-002 | 1 |
| 7 | | Latch | 401682-001 | 2 |
| 8 | | Button, Latch | 402106-001 | 2 |
| 9 | | Screw, Shoulder | 402214-001 | 4 |
| 10 | | Spring, Compression | 402315-001 | 2 |
| 11 | | Plate, Chassis Ground, Bottom/Front | 402317-001 | 1 |
| 12 | | Pin, Latch | 402806-001 | 2 |
| 13 | A7 | Power Indicator PCB | 403170-011 | 1 |
| 14 | A5 | Fan PCB | 403549-002 | 1 |
| 15 | | Spring, Chassis Ground, Rear | 403741-001 | AR |
| 16 | | Screw, BDGH, Phillips, 4-40 x 7/8 | 404069-001 | 2 |
| 17 | | Insulator, Bottom Shield | 404188-001 | 2 |
| 18 | | Carton, Shipping | 404211-003 | 1 |
| 19 | | Foam, Insert | 404211-004 | 1 |
| 20 | | Label, Blank | 404525-006 | 1 |
| 21 | | Trim, Rubber, Front Bezel | 404620-001 | 1 |
| 22 | | Mounting Strap, Trim | 404621-001 | 1 |
| 23 | | Plate, Chassis Ground, Rear | 404680-002 | 1 |
| 25 | | Spring, Latch | 406019-001 | 2 |
| 26 | | Pin, Latch | 406037-001 | 2 |
| 27 | | Bracket, Power Supply PCB | 406254-001 | 1 |
| 28 | W2 | Connector, Header, Dual, 64-Pin | 407452-002 | 1 |
| 29 | A9 | 600 Acquisition Module, 10-Lead | 417122-001 | 1 |
| 30 | | Front Bezel, Tram | 412659-001 | 1 |
| 31 | | Label, Pulse Oximetry, Nellcor (Determined by Destination) | 413831-002 | 1 |
| 32 | A4 | Pulse Oximetry Assembly (Including Pulse Oximetry PCB, PN 800674-00X) | 414409-001 | 1 |
| 33 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 4502-406 | 2 |
| 34 | | Screw, BDGH, Phillips, 4-40 x 1-1/4 | 4502-440 | 4 |
| 35 | | Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16 | 4505-406 | 6 |
| 36 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 45074-406 | 16 |
| 37 | | Screw, BDGH, Phillips, 4-40 x 3/8 | 45074-412 | 2 |
| 38 | | Screw, BDGH, Phillips, 4-40 x 5/8 | 45074-420 | 2 |
| 39 | | Screw, BDGH, Phillips, 4-40 x 3/4 | 45074-424 | 4 |
| 40 | | Nut, Hex, 4-40 | 4521-304 | 2 |

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 41 | | Adhesive, Diecut, Front Right | 415098-001 | 1 |
| 42 | A2 | Module Processor PCB | 800210-005 | 1 |
| 43 | W1 | Harness, Pulse Oximetry PCB-to-Connector | 800892-001 | 1 |
| 44 | | Label, UL (Determined by Destination) | 408230-002 | 1 |
| 45 | | Label, 60 Hertz | 411091-018 | 1 |
| 45 | | Label, 50 Hertz | 411091-019 | 1 |
| 46 | | Label, Top, English (Determined by Destination) | 411175-009 | 1 |
| 46 | | Label, Top, German (Determined by Destination) | 411175-010 | 1 |
| 46 | | Label, Top, French (Determined by Destination) | 411175-011 | 1 |
| 46 | | Label, Top, Swedish (Determined by Destination) | 411175-012 | 1 |
| 46 | | Label, Top, Spanish (Determined by Destination) | 411175-013 | 1 |
| 46 | | Label, Top, Italian (Determined by Destination) | 411175-014 | 1 |
| 46 | | Label, Top, Dutch (Determined by Destination) | 411175-015 | 1 |
| 47 | | Label, Front, 650SL, English (Determined by Destination) | 413840-001 | 1 |
| 47 | | Label, Front, 650SL, German (Determined by Destination) | 413840-002 | 1 |
| 47 | | Label, Front, 650SL, French (Determined by Destination) | 413840-003 | 1 |
| 47 | | Label, Front, 650SL, Swedish (Determined by Destination) | 413840-004 | 1 |
| 47 | | Label, Front, 650SL, Spanish (Determined by Destination) | 413840-005 | 1 |
| 47 | | Label, Front, 650SL, Italian (Determined by Destination) | 413840-006 | 1 |
| 47 | | Label, Front, 650SL, Dutch (Determined by Destination) | 413840-007 | 1 |
| 48 | | Label, Cover, English (Determined by Destination) | 414050-001 | 1 |
| 48 | | Label, Cover, German (Determined by Destination) | 414050-002 | 1 |
| 48 | | Label, Cover, French (Determined by Destination) | 414050-003 | 1 |
| 48 | | Label, Cover, Swedish (Determined by Destination) | 414050-004 | 1 |
| 48 | | Label, Cover, Spanish (Determined by Destination) | 414050-005 | 1 |
| 48 | | Label, Cover, Italian (Determined by Destination) | 414050-006 | 1 |
| 48 | | Label, Cover, International (Determined by Destination) | 414050-007 | 1 |
| 49 | | Scew, PHD, 4-40 x 0.188, Modified (Determined by Destination) | 409009-001 | 1 |
| 49 | | Scew, PHD, 4-40 x 0.188, Determined by Destination) | 45074-406 | 1 |
| 50 | | Adhesive, Diecut, Front Left | 415098-002 | 1 |
| 51 | | Tram 100 - 850 A & SL Module Service Manaul | 404422-065 | 1 |
| 52 | | Label, CE Mark | 408230-008 | 1 |
| 53 | | PC Post, 2 x 7 | 412062-004 | 1 |
| 54 | | PC Post, 2 x 11 | 412062-005 | 1 |
| 55 | | Spring, Chassis Ground, Small | 414610-001 | AR |

# Assembly Revisions PN 412656

The baseline revision for this assembly is pn 412656-001H. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

## PN 412656-001A

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 41 | | Adhesive, Loctite Prism 411 | 4851-082 | 415098-001 | AR |
| 42 | | Module Processor PCB | 800210-002 | 800210-005 | 1 |
| 49 | | Spring, Chassis Ground, Small | Not Used | 414610-001 | AR |
| 50 | | Adhesive, Diecut Front Left | Not Used | 415098-002 | 1 |
| 52 | | Label, CE Mark | Not Used | 408230-008 | 1 |
| 53 | | PC Post, 2 x 7 | Not Used | 412062-004 | 1 |
| 54 | | PC Post, 2 x 11 | Not Used | 412062-005 | 1 |

## PN 412656-001B

This revision was a documentation change that does not affect this manual.
Refer to pn 412656-001A for changes to the parts list.

## PN 412656-001C

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 42 | | Module Processor PCB | 800210-002 | 800210-005 | 1 |
| 52 | | Label, CE Mark | Not Used | 408230-008 | 1 |
| 53 | | PC Post, 2 x 7 | Not Used | 412062-004 | 1 |
| 54 | | PC Post, 2 x 11 | Not Used | 412062-005 | 1 |

## PN 412656-001D

This revision was a documentation change that does not affect this manual.
Refer to pn 412656-001C for changes to the parts list.

## PN 412656-001E

This revision was a documentation change that does not affect this manual.
Refer to pn 412656-001C for changes to the parts list.

## PN 412656-001F

This revision was a documentation change that does not affect this manual.
Refer to pn 412656-001C for changes to the parts list.

## PN 412656-001G

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 29 | A9 | DAS 600 Module, 10-Lead | 411168-001 | 417122-001 | 1 |

# 15 TRAM 800A/SL MODULE

# PN 411080/411024

**General** .......................................................................... **15-2**
Circuit Boards .................................................................... 15-2

**Exploded View PN 411080-001J** ...................................... **15-3**

**Schematic Diagram PN 411080-001J** ............................... **15-5**

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# General

## Circuit Boards

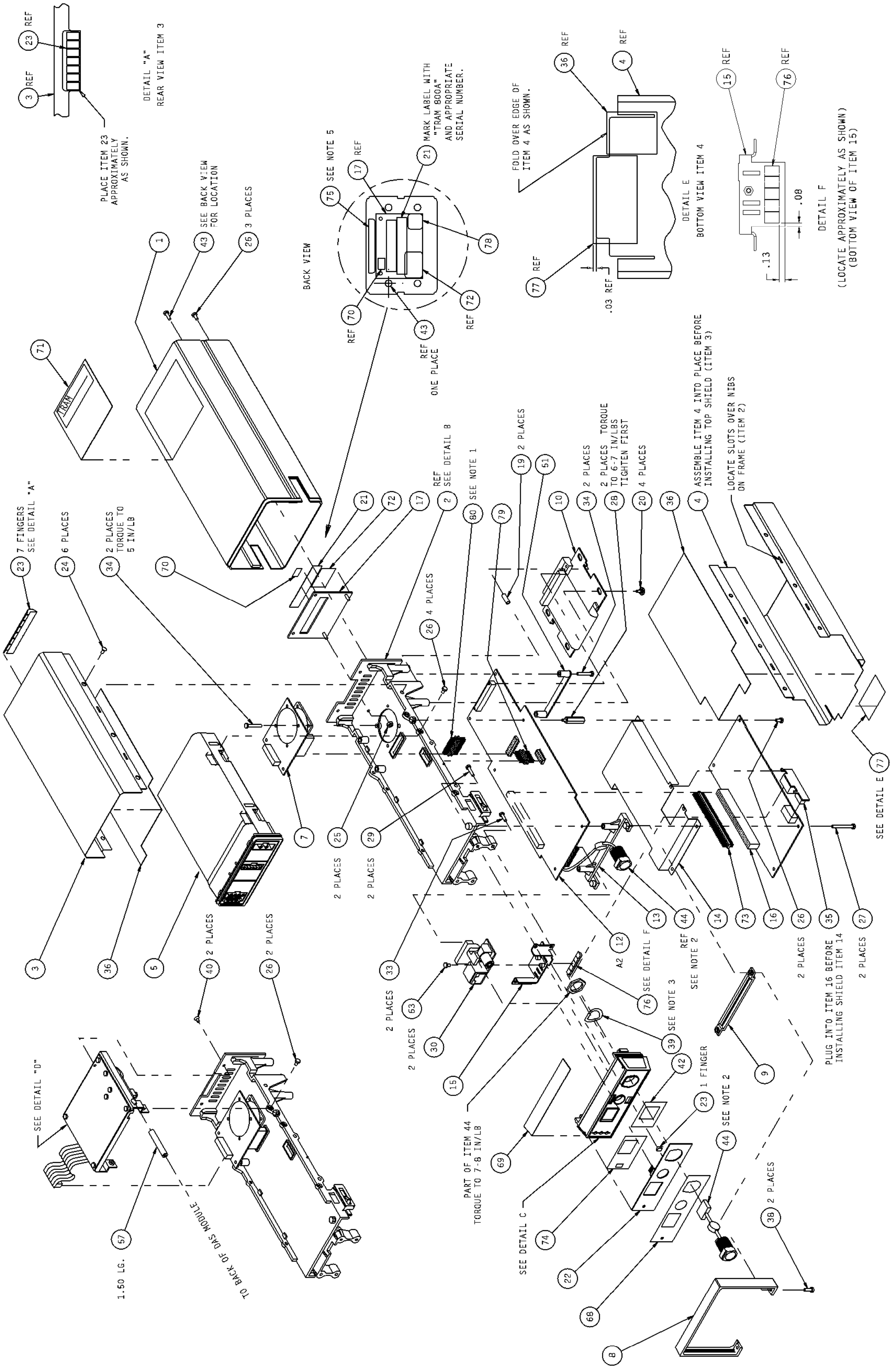
Details about the circuit boards contained in the Tram 800A/SL are discussed in later chapters arranged by part number.

**Table 15-1. Circuit Board Overview**

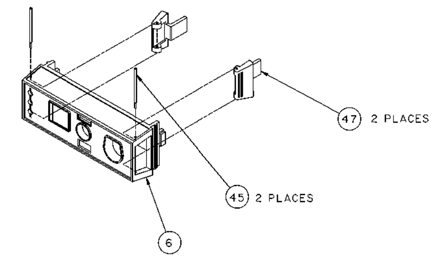
| Module Type | Upper Level | Leadwire Configuration | DAS Module | Acquisition Processor PCB | Module Processor PCB |
|---|---|---|---|---|---|
| Tram 800A | 411080-001A–H | 5-Leadwire | 411068-001 | 800330-011 | 800210-005 |
| Tram 800A | 411080-001J | 5-Leadwire | 417124-001<br>(Replaced 411068-001) | 801040-002 | 800210-005 |
| Tram 800SL | 411024-001A–H | 10-Leadwire | 411025-001 | 800330-012 | 800210-005 |
| Tram 800SL | 411024-001J | 10-Leadwire | 417123-001<br>(Replaced 411025-001) | 801040-001 | 800210-005 |

# Exploded View PN 411080-001J

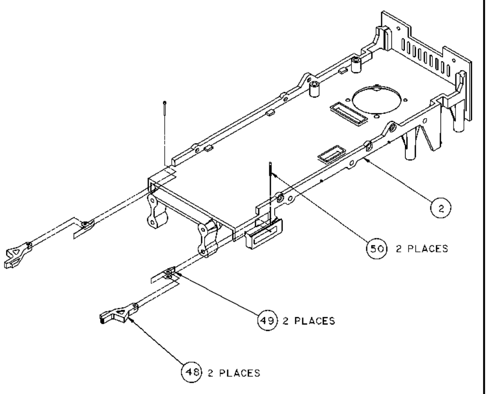
1 of 2


23 REF
3 REF
DETAIL "A" REAR VIEW ITEM 3
PLACE ITEM 23 APPROXIMATELY AS SHOWN.
1
43 SEE BACK VIEW FOR LOCATION
26 3 PLACES
BACK VIEW
75 SEE NOTE 5
17 REF
21 MARK LABEL WITH "TRAM 800A" AND APPROPRIATE SERIAL NUMBER.
78
72 REF
43 REF ONE PLACE
70 REF
36 REF
4 REF
FOLD OVER EDGE OF ITEM 4 AS SHOWN.
77 REF
.03 REF
DETAIL E BOTTOM VIEW ITEM 4
15 REF
76 REF
.08
.13
DETAIL F (LOCATE APPROXIMATELY AS SHOWN) (BOTTOM VIEW OF ITEM 15)
71
TRAM
23 7 FINGERS SEE DETAIL "A"
24 6 PLACES
34 2 PLACES TORQUE TO 5 IN/LB
70
21
72
17
2 REF SEE DETAIL B
80 SEE NOTE 1
26 4 PLACES
79
19 2 PLACES
51
10
34 2 PLACES
28 2 PLACES TORQUE TO 6-7 IN/LBS TIGHTEN FIRST
20 4 PLACES
36
4 ASSEMBLE ITEM 4 INTO PLACE BEFORE INSTALLING TOP SHIELD (ITEM 3)
LOCATE SLOTS OVER NIBS ON FRAME (ITEM 2)
77 SEE DETAIL E
3
36
5
40 2 PLACES
26 2 PLACES
7
25 2 PLACES
29 2 PLACES
33
63 2 PLACES
30 2 PLACES
15
76 SEE DETAIL F
A2 12
13
44 REF SEE NOTE 2
14
73
16
26 2 PLACES
35 PLUG INTO ITEM 16 BEFORE INSTALLING SHIELD ITEM 14
27 2 PLACES
39 SEE NOTE 3
9
42
23 1 FINGER
44 SEE NOTE 2
38 2 PLACES
69
PART OF ITEM 44 TORQUE TO 7-8 IN/LB
74 SEE DETAIL C
22
68
8
SEE DETAIL "D"
57 1.50 LG.
TO BACK OF DAS MODULE

**2 of 2**

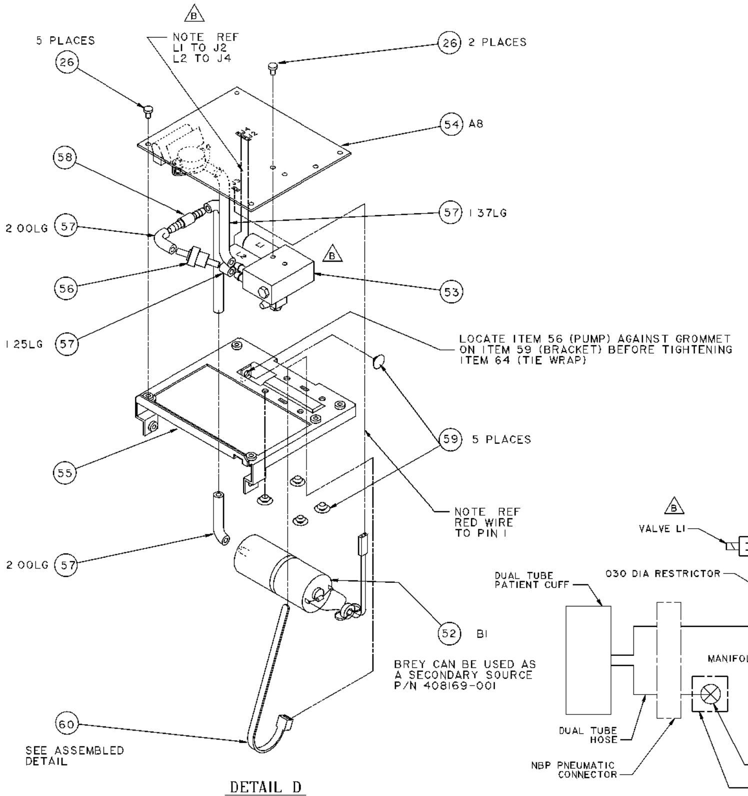

47
2 PLACES
45
2 PLACES
6

DETAIL C

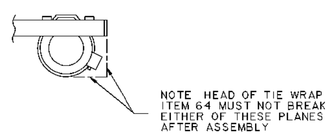

2
50
2 PLACES
49
2 PLACES
48
2 PLACES

DETAIL B

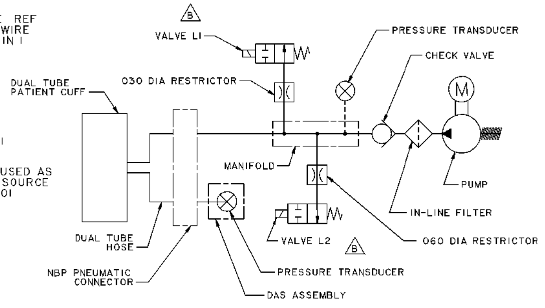
NOTES;
1. INSERT LONGER PIN SIDE INTO ITEM 12. PINS MUST EXTEND BEYOND MATING CONNECTOR ON ITEM 12 WHEN ASSEMBLED.
1. PULSE OXIMETRY CABLE ITEM 44 TO BE ROUTED TO THE INSIDE OF FIRST STANDOFF ON ITEM 13, THEN BEHIND NON-ISO INPUT PCB (ITEM 30) FLEX CIRCUIT CONNECTOR AND LASTLY TO THE INSIDE OF SECOND STANDOFF ON ITEM 13.
3. CURVED WASHER MUST BE INSTALLED CONCAVE SIDE OUT.
4. SWITCH SETTING MUST BE MADE FOR EACH CONFIGURATION. SEE PRODUCT LEVEL NOTE. (REFER TO SWITCH CHART)
5. MARK LABEL ITEM 75, AS FOLLOWS: ZULASSUNGSKENNZEICHEN: 01/M-305/94.
6. CHECK APPROPRIATE BOX ON SIDE OF CARTON TO INDICATE UNIT BEING SHIPPED.
7.
8. SHIP ITEM 67 WITH EACH UNIT.
9. LOOSE ITEMS MAY BE SHIPPED WITH THE UNIT IF SPACE PERMITS OR PACKAGED AND SHIPPED SEPARATELY.


B
5 PLACES
26
NOTE REF
L1 TO J2
L2 TO J4
26
2 PLACES
54
A8
58
57
1 37LG
2 00LG
57
B
56
53
1 25LG
57
LOCATE ITEM 56 (PUMP) AGAINST GROMMET ON ITEM 59 (BRACKET) BEFORE TIGHTENING ITEM 64 (TIE WRAP)
59
5 PLACES
55
NOTE REF
RED WIRE
TO PIN 1
2 00LG
57
52
B1
BREY CAN BE USED AS A SECONDARY SOURCE P/N 408169-001
60
SEE ASSEMBLED DETAIL

DETAIL D


NOTE HEAD OF TIE WRAP ITEM 64 MUST NOT BREAK EITHER OF THESE PLANES AFTER ASSEMBLY

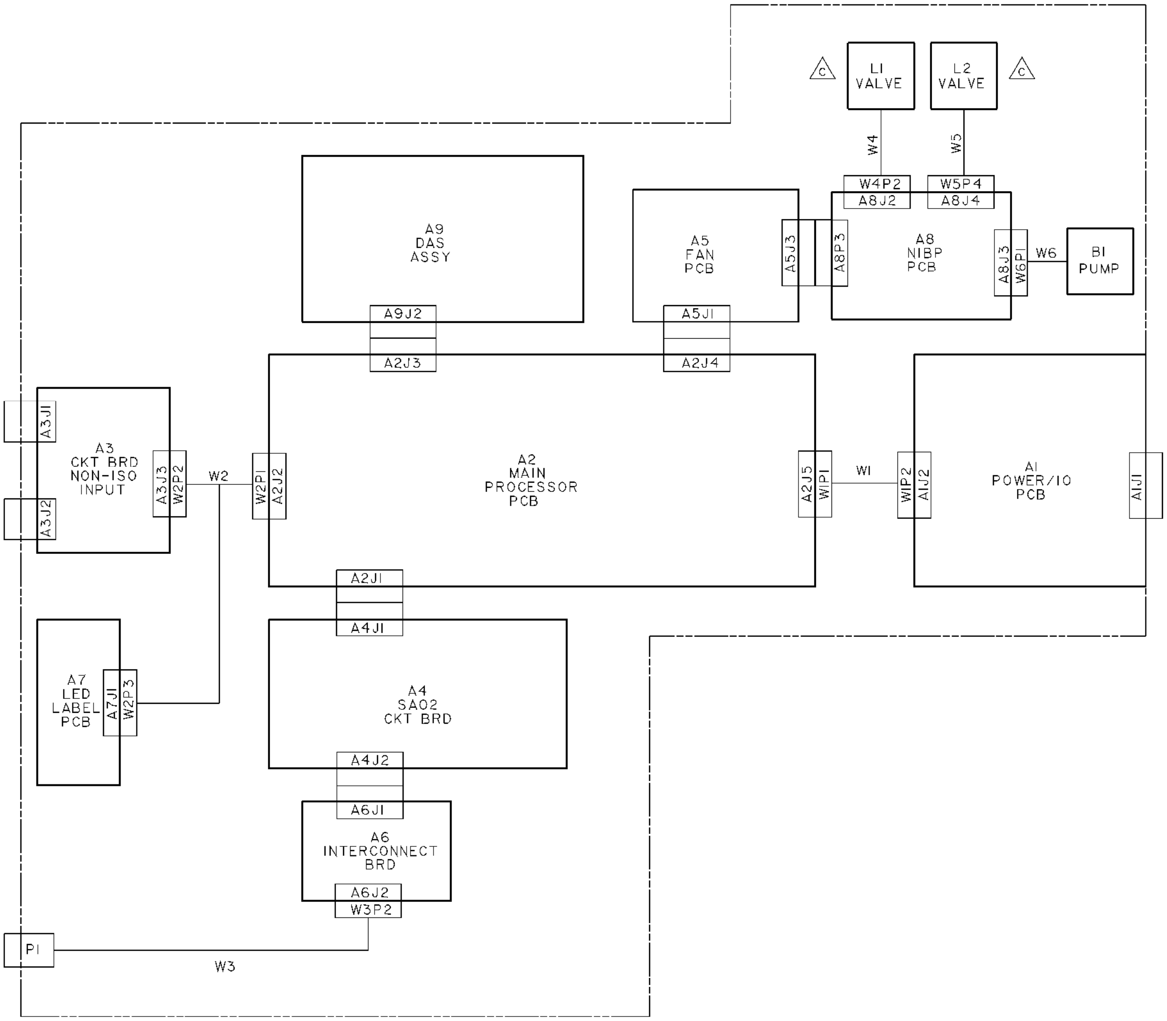
*ASSEMBLED DETAIL*

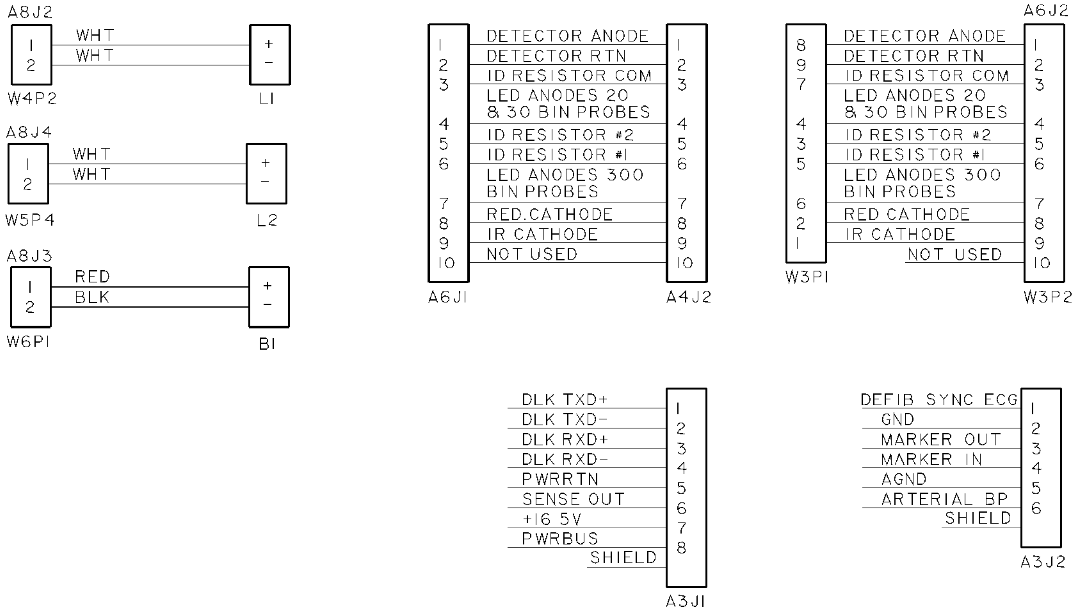

B
VALVE L1
PRESSURE TRANSDUCER
CHECK VALVE
M
DUAL TUBE
PATIENT CUFF
030 DIA RESTRICTOR
MANIFOLD
PUMP
IN-LINE FILTER
VALVE L2
B
060 DIA RESTRICTOR
DUAL TUBE
HOSE
NBP PNEUMATIC
CONNECTOR
PRESSURE TRANSDUCER
DAS ASSEMBLY

*PNEUMATIC SCHEMATIC*

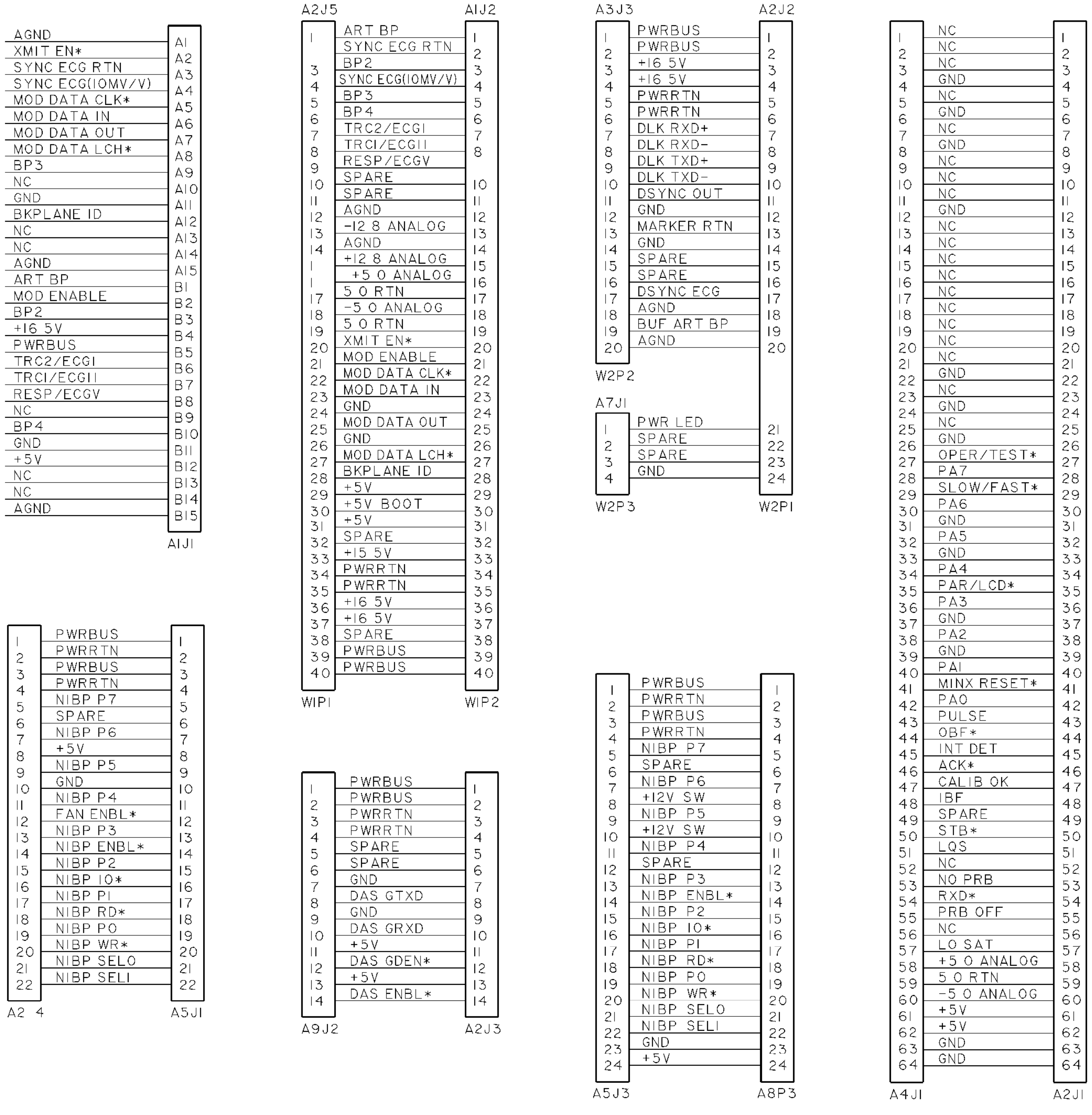
# Schematic Diagram PN 411080-001J

1 of 2


L1 VALVE
L2 VALVE
C
C
W4
W5
W4P2
A8J2
W5P4
A8J4
A9 DAS ASSY
A9J2
A2J3
A5 FAN PCB
A5J3
A8P3
A5J1
A2J4
A8 NIBP PCB
A8J3
W6P1
W6
B1 PUMP
A3J1
A3J2
A3 CKT BRD NON-ISO INPUT
A3J3
W2P2
W2
W2P1
A2J2
A2 MAIN PROCESSOR PCB
A2J5
W1P1
W1
W1P2
A1J2
A1 POWER/IO PCB
A1J1
A2J1
A4J1
A7 LED LABEL PCB
A7J1
W2P3
A4 SAO2 CKT BRD
A4J2
A6J1
A6 INTERCONNECT BRD
A6J2
W3P2
P1
W3


A8J2
1
2
WHT
WHT
+
−
W4P2
L1
A8J4
1
2
WHT
WHT
+
−
W5P4
L2
A8J3
1
2
RED
BLK
+
−
W6P1
B1
1 DETECTOR ANODE 1
2 DETECTOR RTN 2
3 ID RESISTOR COM 3
4 LED ANODES 20 & 30 BIN PROBES 4
5 ID RESISTOR #2 5
6 ID RESISTOR #1 6
7 LED ANODES 300 BIN PROBES 7
8 RED.CATHODE 8
9 IR CATHODE 9
10 NOT USED 10
A6J1
A4J2
A6J2
8 DETECTOR ANODE 1
9 DETECTOR RTN 2
7 ID RESISTOR COM 3
4 LED ANODES 20 & 30 BIN PROBES 4
3 ID RESISTOR #2 5
5 ID RESISTOR #1 6
6 LED ANODES 300 BIN PROBES 7
2 RED CATHODE 8
1 IR CATHODE 9
NOT USED 10
W3P1
W3P2
DLK TXD+ 1
DLK TXD− 2
DLK RXD+ 3
DLK RXD− 4
PWRRTN 5
SENSE OUT 6
+16 5V 7
PWRBUS 8
SHIELD
A3J1
DEFIB SYNC ECG 1
GND 2
MARKER OUT 3
MARKER IN 4
AGND 5
ARTERIAL BP 6
SHIELD
A3J2

**2 of 2**


A1J1
AGND
XMIT EN*
SYNC ECG RTN
SYNC ECG(10MV/V)
MOD DATA CLK*
MOD DATA IN
MOD DATA OUT
MOD DATA LCH*
BP3
NC
GND
BKPLANE ID
NC
NC
AGND
ART BP
MOD ENABLE
BP2
+16 5V
PWRBUS
TRC2/ECGI
TRC1/ECGII
RESP/ECGV
NC
BP4
GND
+5V
NC
NC
AGND
A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B13 B14 B15
A2J5
A1J2
W1P1
W1P2
ART BP
SYNC ECG RTN
BP2
SYNC ECG(10MV/V)
BP3
BP4
TRC2/ECGI
TRC1/ECGII
RESP/ECGV
SPARE
SPARE
AGND
-12 8 ANALOG
AGND
+12 8 ANALOG
+5 0 ANALOG
5 0 RTN
-5 0 ANALOG
5 0 RTN
XMIT EN*
MOD ENABLE
MOD DATA CLK*
MOD DATA IN
GND
MOD DATA OUT
GND
MOD DATA LCH*
BKPLANE ID
+5V
+5V BOOT
+5V
SPARE
+15 5V
PWRRTN
PWRRTN
+16 5V
+16 5V
SPARE
PWRBUS
PWRBUS
A3J3
A2J2
W2P2
W2P1
PWRBUS
PWRBUS
+16 5V
+16 5V
PWRRTN
PWRRTN
DLK RXD+
DLK RXD-
DLK TXD+
DLK TXD-
DSYNC OUT
GND
MARKER RTN
GND
SPARE
SPARE
DSYNC ECG
AGND
BUF ART BP
AGND
A7J1
W2P3
PWR LED
SPARE
SPARE
GND
A4J1
A2J1
NC
NC
NC
GND
NC
GND
NC
GND
NC
NC
NC
GND
NC
NC
NC
NC
NC
NC
NC
NC
NC
NC
GND
NC
GND
NC
GND
OPER/TEST*
PA7
SLOW/FAST*
PA6
GND
PA5
GND
PA4
PAR/LCD*
PA3
GND
PA2
GND
PA1
MINX RESET*
PA0
PULSE
OBF*
INT DET
ACK*
CALIB OK
IBF
SPARE
STB*
LQS
NC
NO PRB
RXD*
PRB OFF
NC
LO SAT
+5 0 ANALOG
5 0 RTN
-5 0 ANALOG
+5V
+5V
GND
GND
A2 4
A5J1
PWRBUS
PWRRTN
PWRBUS
PWRRTN
NIBP P7
SPARE
NIBP P6
+5V
NIBP P5
GND
NIBP P4
FAN ENBL*
NIBP P3
NIBP ENBL*
NIBP P2
NIBP 10*
NIBP P1
NIBP RD*
NIBP P0
NIBP WR*
NIBP SEL0
NIBP SEL1
A9J2
A2J3
PWRBUS
PWRBUS
PWRRTN
PWRRTN
SPARE
SPARE
GND
DAS GTXD
GND
DAS GRXD
+5V
DAS GDEN*
+5V
DAS ENBL*
A5J3
A8P3
PWRBUS
PWRRTN
PWRBUS
PWRRTN
NIBP P7
SPARE
NIBP P6
+12V SW
NIBP P5
+12V SW
NIBP P4
SPARE
NIBP P3
NIBP ENBL*
NIBP P2
NIBP 10*
NIBP P1
NIBP RD*
NIBP P0
NIBP WR*
NIBP SEL0
NIBP SEL1
GND
+5V

# Parts List PN 411080-001J

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 1 | | Cover, Module | 400895-001 | 1 |
| 2 | | Frame | 400982-001 | 1 |
| 3 | | Shield, Top | 401679-001 | 1 |
| 4 | | Shield, Bottom | 401679-002 | 1 |
| 5 | A9 | 800 Acquisition Module, 5-Lead | 417124-001 | 1 |
| 6 | | Front Bezel, Lower | 401105-004 | 1 |
| 7 | A5 | Fan PCB | 403549-002 | 1 |
| 8 | | Trim, Rubber, Front Bezel | 404620-001 | 1 |
| 9 | | Mounting Strap, Trim | 404621-001 | 1 |
| 10 | A1 | Power Supply PCB | 401309-002 | 1 |
| 12 | A2 | Module Processor PCB | 800210-005 | 1 |
| 13 | | Circuit Board/Bezel Mount | 404762-001 | 1 |
| 14 | | Shield, Pulse Oximetry PCB | 401680-001 | 1 |
| 15 | | Plate, Chassis Ground, Bottom/Front | 402317-001 | 1 |
| 16 | A4 | Pulse Oximetry PCB | 401189-001 | 1 |
| 17 | | Plate, Chassis Ground, Rear | 404680-002 | 1 |
| 19 | | Spring, Compression | 402315-001 | 2 |
| 20 | | Screw, Power Supply PCB Mounting, SST, 4-40 | 402214-001 | 4 |
| 21 | | Label, Model/Serial Number | 404525-006 | 1 |
| 22 | A7 | Power Indicator PCB | 403170-008 | 1 |
| 23 | | Spring, Chassis Ground, Rear | 403741-001 | AR |
| 24 | | Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16 | 4505-406 | 6 |
| 25 | | Nut, Hex, 4-40 | 4521-304 | 2 |
| 26 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 45074-406 | 18 |
| 27 | | Screw, BDGH, Phillips, 4-40 x 1-3/8 | 45074-438 | 2 |
| 28 | | Spacer, Male/Female, 4-40 x 0.875 | 4656-414 | 2 |
| 29 | | Screw, 4-40 x 7/8 | 404069-001 | 2 |
| 30 | A3 | Non-Isolated Input PCB | 401315-002 | 1 |
| 31 | | Carton, Shipping | 404211-003 | 1 |
| 32 | | Foam Insert | 404211-004 | 2 |
| 33 | | Screw, BDGH, Phillips, 4-40 x 5/8 | 45074-420 | 2 |
| 34 | | Screw, BDGH, Phillips, 4-40 x 3/4 | 45074-424 | 4 |
| 35 | A6 | Interconnect PCB | 800006-001 | 1 |
| 36 | | Insulator, Bottom Shield | 404188-001 | 2 |
| 38 | | Screw, BDGH, Phillips, 4-40 x 3/8 | 45074-412 | 2 |
| 39 | | Washer, Pulse Oximetry Connector | 4550-250 | 1 |
| 40 | | Screw, FLH, Phillips, SST, 4-40 x 3/8 | 4505-412 | 2 |
| 41 | | Tram 100 - 850 A and SL Modules Service Manual | 404422-065 | 1 |
| 42 | | Adhesive, Diecut, Front Right | 415098-001 | 1 |
| 43 | | Screw, PHD, 4-40 x 0.188, Modified (Determined by Destination) | 409009-001 | 1 |

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 43 | | Screw, PHD, 4-40 x 0.188, (Determined by Destination) | 45074-406 | 1 |
| 44 | W3 | Harness Assembly, SpO2 – w/Choke | 700091-004 | 1 |
| 45 | | Pin, Latch | 402806-001 | 2 |
| 46 | | Spring, Flat, SST | 405041-001 | 2 |
| 47 | | Button, Latch | 402106-001 | 1 |
| 48 | | Latch | 401682-001 | 1 |
| 49 | | Spring, Latch | 406019-001 | 2 |
| 50 | | Pin, Latch | 406037-001 | 2 |
| 51 | | Bracket, Power Supply PCB | 406254-001 | 1 |
| 52 | B1 | Pump Assembly, NBP, w/Harness | 408169-002 | 1 |
| 53 | A10 | NBP Valve Assembly | 416153-001 | 1 |
| 54 | A8 | NBP PCB | 800316-002 | 1 |
| 55 | | Bracket, NBP Mounting | 404296-001 | 1 |
| 56 | | Check Valve, 0.125 ID | 404675-001 | 1 |
| 57 | | Tubing, Silastic | 401582-001 | AR |
| 58 | | Filter, 43 Micron | 404679-001 | 1 |
| 59 | | Grommet, 1/4 Dia, 1/8 High, 1/16 Panel Thickness | 404749-001 | 5 |
| 60 | | Tie Wrap | 4535-002 | 1 |
| 63 | | Screw, PNH, Phillips, SST, 4-40 x 3/16 | 4502-406 | 2 |
| 67 | | SpO2 Sensor, Adult, Finger, Package of 6 | 411667-001 | 1 |
| 68 | | Label, Front, 800SL, English (Determined by Destination) | 411043-002 | 1 |
| 68 | | Label, Front, 800A, German (Determined by Destination) | 411043-003 | 1 |
| 68 | | Label, Front, 800A, French (Determined by Destination) | 411043-004 | 1 |
| 68 | | Label, Front, 800A, Swedish (Determined by Destination) | 411043-005 | 1 |
| 68 | | Label, Front, 800A, Spanish (Determined by Destination) | 411043-006 | 1 |
| 68 | | Label, Front, 800A, Italian (Determined by Destination) | 411043-007 | 1 |
| 68 | | Label, Front, 800A, Dutch (Determined by Destination) | 411043-008 | 1 |
| 69 | | Label, Top, English (Determined by Destination) | 411091-009 | 1 |
| 69 | | Label, Top, German (Determined by Destination) | 411091-010 | 1 |
| 69 | | Label, Top, French (Determined by Destination) | 411091-011 | 1 |
| 69 | | Label, Top, Swedish (Determined by Destination) | 411091-012 | 1 |
| 69 | | Label, Top, Spanish (Determined by Destination) | 411091-013 | 1 |
| 69 | | Label, Top, Italian (Determined by Destination) | 411091-014 | 1 |
| 69 | | Label, Top, Dutch (Determined by Destination) | 411091-015 | 1 |
| 70 | | Label, 60 Hertz (Determined by Destination) | 411091-018 | 1 |
| 70 | | Label, 50 Hertz (Determined by Destination) | 411091-019 | 1 |
| 71 | | Label, Cover, English (Determined by Destination) | 411043-016 | 1 |

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 71 | | Label, Cover, German (Determined by Destination) | 411043-020 | 1 |
| 71 | | Label, Cover, French (Determined by Destination) | 411043-021 | 1 |
| 71 | | Label, Cover, Swedish (Determined by Destination) | 411043-022 | 1 |
| 71 | | Label, Cover, Spanish (Determined by Destination) | 411043-023 | 1 |
| 71 | | Label, Cover, Italian (Determined by Destination) | 411043-024 | 1 |
| 71 | | Label, Cover, International (Determined by Destination) | 411043-025 | 1 |
| 72 | | Label, TUV (Determined by Destination) | 408103-003 | 1 |
| 72 | | Label, UL Listed (Determined by Destination) | 408230-002 | 1 |
| 73 | P1 | Connector, Header, 64-Pin, w/Ferrites | 409203-001 | 1 |
| 74 | | Adhesive, Diecut, Front Left | 415098-002 | 1 |
| 76 | | Spring, Chassis Ground, Small | 414610-001 | AR |
| 77 | | Adhesive, Mylar | 415316-001 | 1 |
| 78 | | Label, CE Mark | 408230-008 | 1 |
| 79 | | PC Post, 2 x 7 | 412062-004 | 1 |
| 80 | | PC Post, 2 x 11 | 412062-005 | 1 |

# Assembly Revisions PN 411080

The baseline revision for this assembly is pn 411080-001J. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

## PN 411080-001C

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 5 | A9 | DAS 800A Module, 10-Lead | 411068-001 | 417124-001 | 1 |
| 11 | | Label Set, Tram 800A | 411043-001 | Not Used | 1 |
| 12 | | Module Processor PCB | 800210-002 | 800210-005 | 1 |
| 42 | | Adhesive, Loctite Prism 411 | 4851-082 | 415098-001 | AR |
| 53 | A6 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 54 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |
| 63 | | Screw, Phillips, STT, 4-40 x 3/16 | Not Used | 4502-406 | 2 |
| 73 | | Connector, Header 64-pin w/Ferrites | Not Used | 409203-001 | 1 |
| 74 | | Adhesive, Diecut Front Left | Not Used | 415098-002 | 1 |
| 76 | | Spring, Chassis Ground, Small | Not Used | 414610-001 | AR |
| 77 | | Adhesive, Mylar | Not Used | 415316-001 | 1 |
| 78 | | Label, CE Mark | Not Used | 408230-008 | 1 |
| 79 | | PC Post, 2 x 7 | Not Used | 412062-004 | 1 |
| 80 | | PC Post, 2 x 11 | Not Used | 412062-005 | 1 |

## PN 411080-001D

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 5 | A9 | DAS 800A Module, 10-Lead | 411068-001 | 417124-001 | 1 |
| 12 | | Module Processor PCB | 800210-002 | 800210-005 | 1 |
| 42 | | Adhesive, Loctite Prism 411 | 4851-082 | 415098-001 | AR |
| 53 | A6 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 54 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |
| 74 | | Adhesive, Diecut Front Left | Not Used | 415098-002 | 1 |
| 76 | | Spring, Chassis Ground, Small | Not Used | 414610-001 | AR |
| 77 | | Adhesive, Mylar | Not Used | 415316-001 | 1 |
| 78 | | Label, CE Mark | Not Used | 408230-008 | 1 |
| 79 | | PC Post, 2 x 7 | Not Used | 412062-004 | 1 |
| 80 | | PC Post, 2 x 11 | Not Used | 412062-005 | 1 |

## PN 411080-001E

This revision was a documentation change that does not affect this manual.
Refer to pn 411080-001D for changes to the parts list.

## PN 411080-001F

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 5 | A9 | DAS 800A Module, 10-Lead | 411068-001 | 417124-001 | 1 |
| 12 | | Module Processor PCB | 800210-002 | 800210-005 | 1 |
| 53 | A6 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 54 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |
| 76 | | Spring, Chassis Ground, Small | Not Used | 414610-001 | AR |
| 77 | | Adhesive, Mylar | Not Used | 415316-001 | 1 |
| 78 | | Label, CE Mark | Not Used | 408230-008 | 1 |
| 79 | | PC Post, 2 x 7 | Not Used | 412062-004 | 1 |
| 80 | | PC Post, 2 x 11 | Not Used | 412062-005 | 1 |

## PN 411080-001G

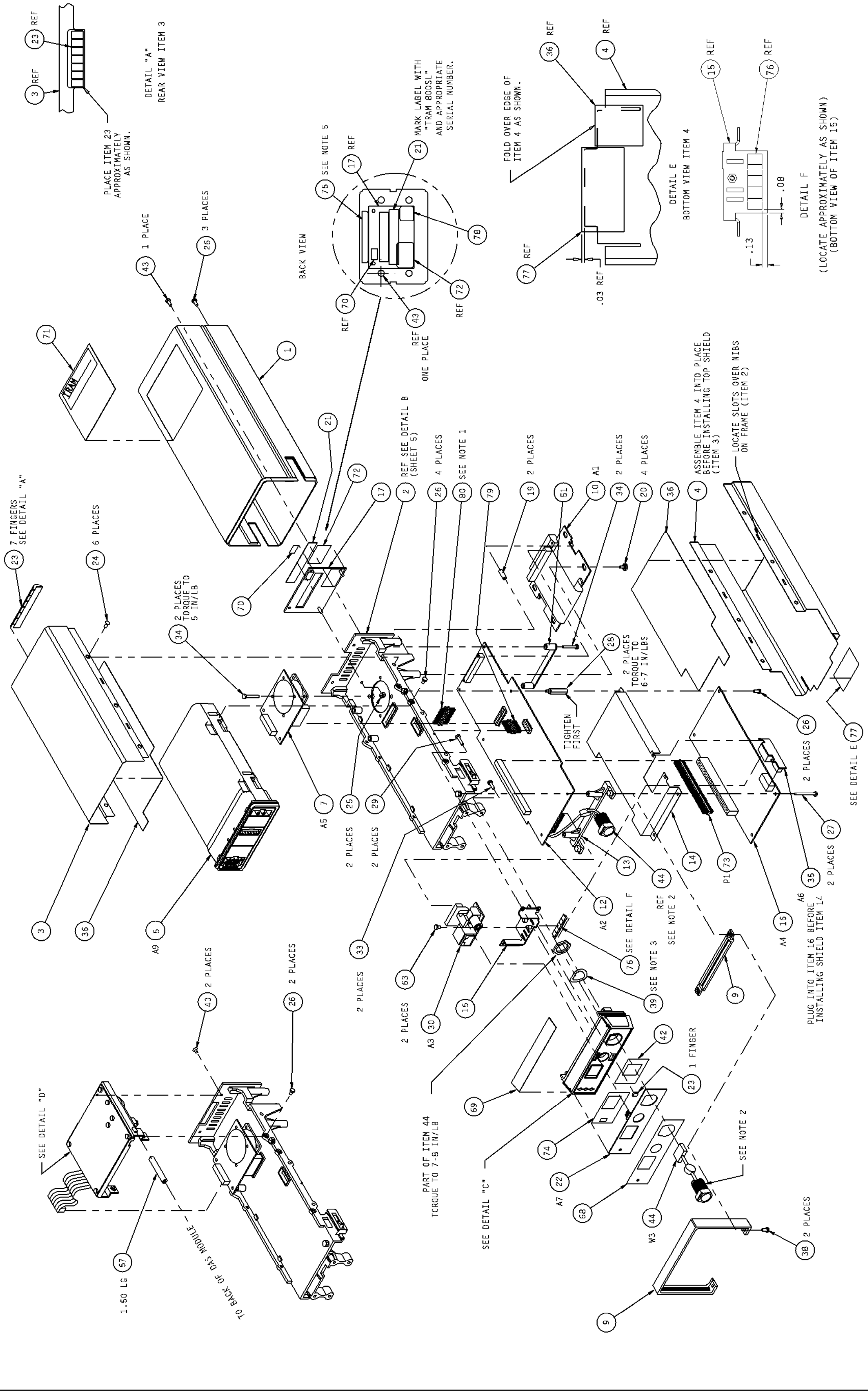
This revision was a documentation change that does not affect this manual.
Refer to pn 411080-001F for changes to the parts list.

## PN 411080-001H

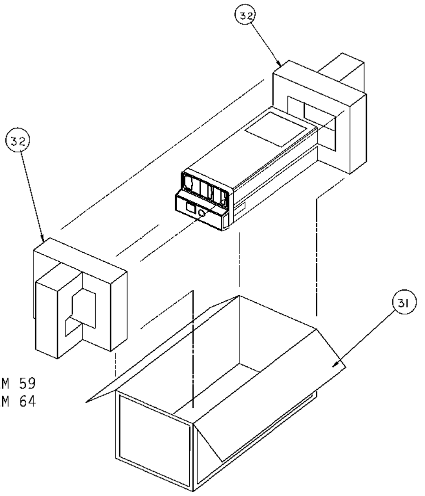
| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 5 | A9 | DAS 800A Module, 10-Lead | 411068-001 | 417124-001 | 1 |
| 53 | A6 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 54 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |

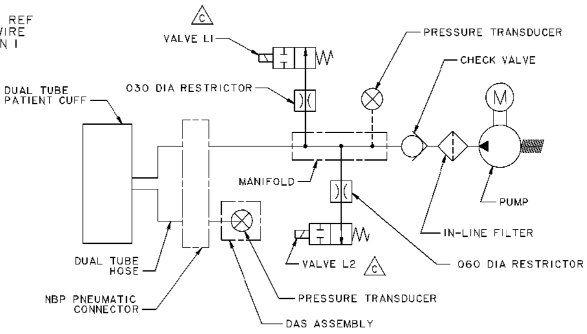
# Exploded View PN 411024-001J

1 of 2

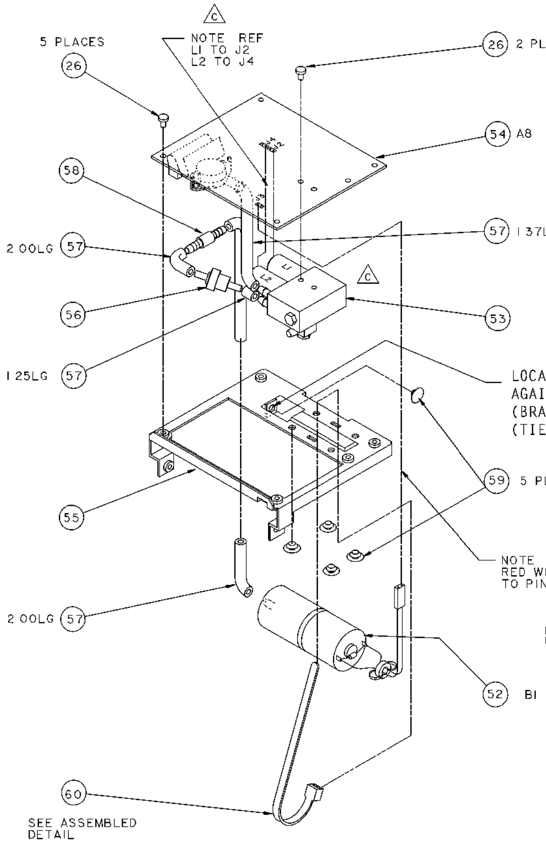

DETAIL "A" REAR VIEW ITEM 3
23 REF
3 REF
PLACE ITEM 23 APPROXIMATELY AS SHOWN.
BACK VIEW
SEE NOTE 5
75
17 REF
21 MARK LABEL WITH "TRAM 800SL" AND APPROPRIATE SERIAL NUMBER.
78
72 REF
43 REF ONE PLACE
70 REF
FOLD OVER EDGE OF ITEM 4 AS SHOWN.
36 REF
4 REF
77 REF
.03 REF
DETAIL E BOTTOM VIEW ITEM 4
15 REF
76 REF
.13
.08
DETAIL F (LOCATE APPROXIMATELY AS SHOWN) (BOTTOM VIEW OF ITEM 15)
43 1 PLACE
26 3 PLACES
71
1
21
72
17
70
2 REF SEE DETAIL B (SHEET 5)
26 4 PLACES
80 SEE NOTE 1
79
19 2 PLACES
51
10 A1
34 2 PLACES
20 4 PLACES
36
4 ASSEMBLE ITEM 4 INTO PLACE BEFORE INSTALLING TOP SHIELD (ITEM 3)
LOCATE SLOTS OVER NIBS ON FRAME (ITEM 2)
23 7 FINGERS SEE DETAIL "A"
24 6 PLACES
34 2 PLACES TORQUE TO 5 IN/LB
28 2 PLACES TORQUE TO 6-7 IN/LBS
TIGHTEN FIRST
26
77 SEE DETAIL E
2 PLACES
27
35 2 PLACES
A6 16
A4
P1 73
14
44 REF SEE NOTE 2
13
A2 12
76 SEE DETAIL F
SEE NOTE 3 39
9 PLUG INTO ITEM 16 BEFORE INSTALLING SHIELD ITEM 14
A5 7
25 2 PLACES
29 2 PLACES
3
36
A9 5
33 2 PLACES
63 2 PLACES
A3 30
15
42
23 1 FINGER
69
74
A7 22
68
W3 44
SEE NOTE 2
38 2 PLACES
9
PART OF ITEM 44 TORQUE TO 7-8 IN/LB
SEE DETAIL "C"
40 2 PLACES
26 2 PLACES
SEE DETAIL "D"
57 1.50 LG
TO BACK OF DAS MODULE

2 of 2



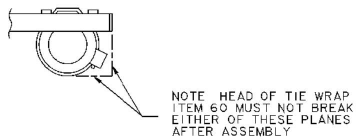

VALVE L1
C
PRESSURE TRANSDUCER
CHECK VALVE
M
DUAL TUBE PATIENT CUFF
030 DIA RESTRICTOR
MANIFOLD
PUMP
IN-LINE FILTER
060 DIA RESTRICTOR
VALVE L2
C
DUAL TUBE HOSE
NBP PNEUMATIC CONNECTOR
PRESSURE TRANSDUCER
DAS ASSEMBLY

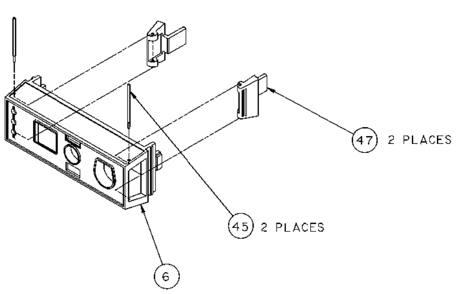
PNEUMATIC SCHEMATIC


5 PLACES
26
NOTE REF
L1 TO J2
L2 TO J4
C
26 2 PLACES
54 A8
58
2 00LG 57
57 1 37LG
C
56
53
1 25LG 57
LOCATE ITEM 56 (PUMP)
AGAINST GROMMET ON ITEM 59
(BRACKET) BEFORING ITEM 64
(TIE WRAP)
59 5 PLACES
55
NOTE REF
RED WIRE
TO PIN 1
2 00LG 57
52 B1
60
SEE ASSEMBLED
DETAIL

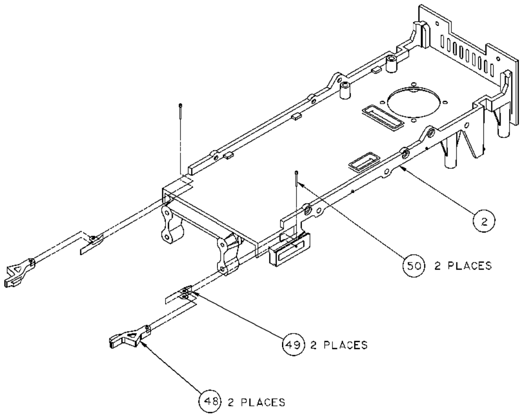
DETAIL D

ASSEMBLED DETAIL


NOTE HEAD OF TIE WRAP
ITEM 60 MUST NOT BREAK
EITHER OF THESE PLANES
AFTER ASSEMBLY


47 2 PLACES
45 2 PLACES
6

DETAIL C


2
50 2 PLACES
49 2 PLACES
48 2 PLACES

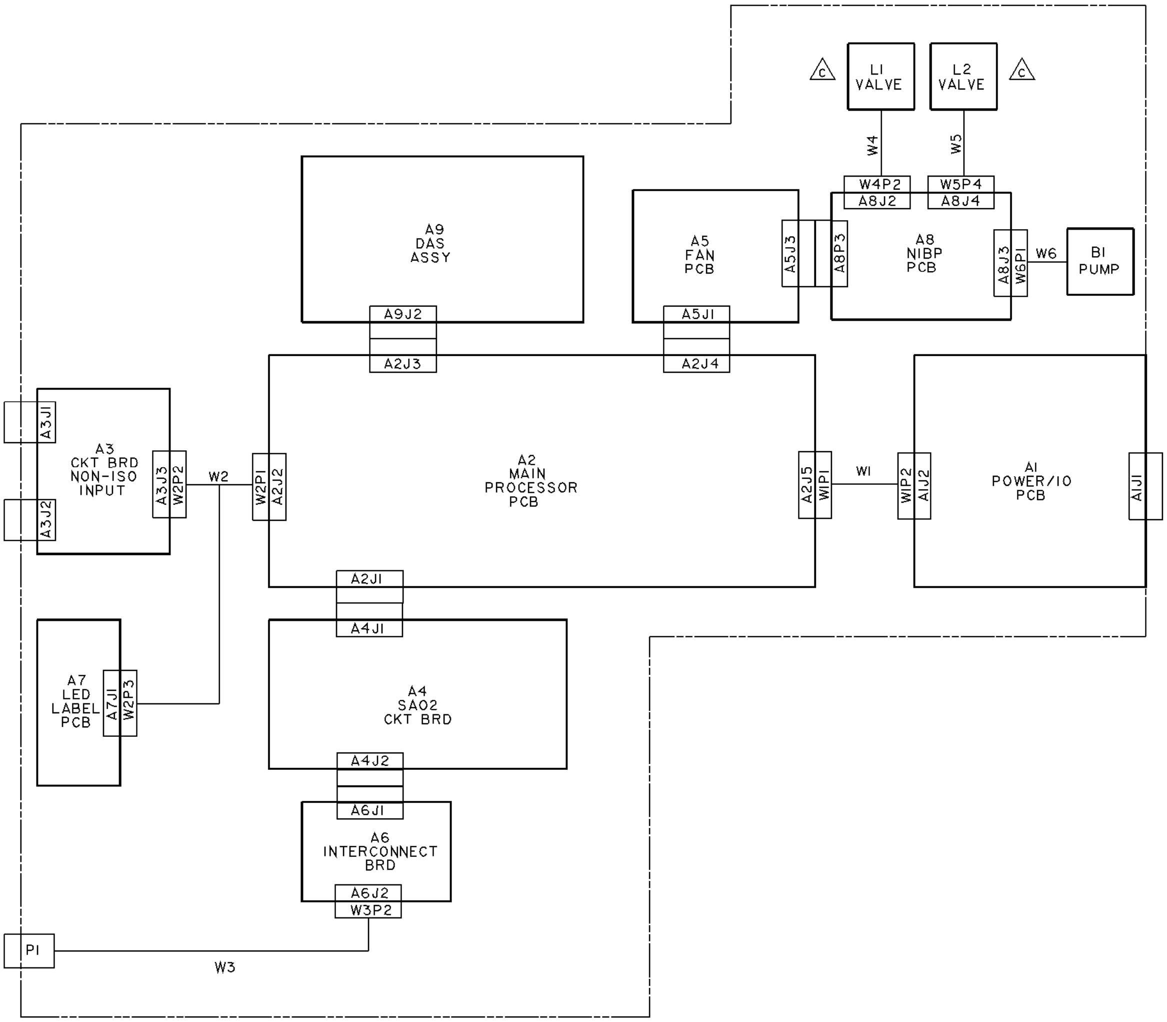
DETAIL B

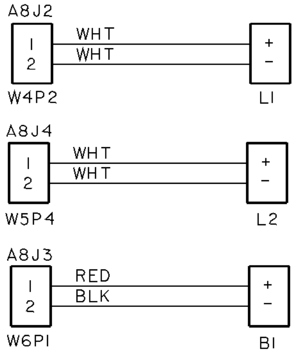
NOTES;

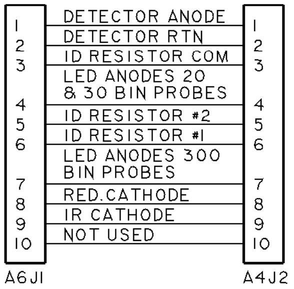
1. INSERT LONGER PIN SIDE INTO ITEM 12. PINS MUST EXTEND BEYOND MATING CONNECTOR ON ITEM 12 WHEN ASSEMBLED.
1. PULSE OXIMETRY CABLE ITEM 44 TO BE ROUTED TO THE INSIDE OF FIRST STANDOFF ON ITEM 13, THEN BEHIND NON-ISO INPUT PCB (ITEM 30) FLEX CIRCUIT CONNECTOR AND LASTLY TO THE INSIDE OF SECOND STANDOFF ON ITEM 13.
3. CURVED WASHER MUST BE INSTALLED CONCAVE SIDE OUT.
4. SWITCH SETTING MUST BE MADE FOR EACH CONFIGURATION. SEE PRODUCT LEVEL NOTE. (REFER TO SWITCH CHART)
5. MARK LABEL ITEM 75, AS FOLLOWS:
   ZULASSUNGSKENNZEICHEN: 01/M-305/94.
6. CHECK APPROPRIATE BOX ON SIDE OF CARTON TO INDICATE UNIT BEING SHIPPED.
7. SHIP ITEM 67 (OXY TIP SIX PACK) WITH EACH UNIT.
8. LOOSE ITEMS MAY BE SHIPPED WITH THE UNIT IF SPACE PERMITS OR PACKAGED AND SHIPPED SEPARATELY.

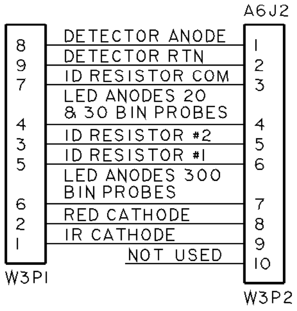
# Schematic Diagram PN 411024-001J

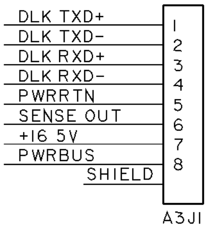
1 of 2

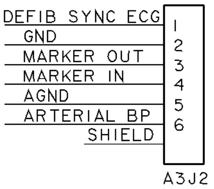

L1 VALVE
L2 VALVE
C
C
W4
W5
W4P2
A8J2
W5P4
A8J4
A9 DAS ASSY
A5 FAN PCB
A5J3
A8P3
A8 NIBP PCB
A8J3
W6P1
W6
B1 PUMP
A9J2
A2J3
A5J1
A2J4
A3J1
A3 CKT BRD NON-ISO INPUT
A3J3
W2P2
W2
W2P1
A2J2
A2 MAIN PROCESSOR PCB
A2J5
W1P1
W1
W1P2
A1J2
A1 POWER/IO PCB
A1J1
A3J2
A2J1
A4J1
A7 LED LABEL PCB
A7J1
W2P3
A4 SA02 CKT BRD
A4J2
A6J1
A6 INTERCONNECT BRD
A6J2
W3P2
P1
W3


A8J2
1
2
WHT
WHT
+
−
W4P2
L1
A8J4
1
2
WHT
WHT
+
−
W5P4
L2
A8J3
1
2
RED
BLK
+
−
W6P1
B1


1 DETECTOR ANODE 1
2 DETECTOR RTN 2
3 ID RESISTOR COM 3
LED ANODES 20 & 30 BIN PROBES
4 ID RESISTOR #2 4
5 ID RESISTOR #1 5
6 LED ANODES 300 BIN PROBES 6
7 RED.CATHODE 7
8 IR CATHODE 8
9 NOT USED 9
10 10
A6J1
A4J2


A6J2
8 DETECTOR ANODE 1
9 DETECTOR RTN 2
7 ID RESISTOR COM 3
LED ANODES 20 & 30 BIN PROBES
4 ID RESISTOR #2 4
3 ID RESISTOR #1 5
5 LED ANODES 300 BIN PROBES 6
6 RED CATHODE 7
2 IR CATHODE 8
1 NOT USED 9
10
W3P1
W3P2


DLK TXD+ 1
DLK TXD− 2
DLK RXD+ 3
DLK RXD− 4
PWRRTN 5
SENSE OUT 6
+16 5V 7
PWRBUS 8
SHIELD
A3J1


DEFIB SYNC ECG 1
GND 2
MARKER OUT 3
MARKER IN 4
AGND 5
ARTERIAL BP 6
SHIELD
A3J2

**2 of 2**

| | A1J1 |
|---|---|
| AGND | A1 |
| XMIT EN* | A2 |
| SYNC ECG RTN | A3 |
| SYNC ECG(10MV/V) | A4 |
| MOD DATA CLK* | A5 |
| MOD DATA IN | A6 |
| MOD DATA OUT | A7 |
| MOD DATA LCH* | A8 |
| BP3 | A9 |
| NC | A10 |
| GND | A11 |
| BKPLANE ID | A12 |
| NC | A13 |
| NC | A14 |
| AGND | A15 |
| ART BP | B1 |
| MOD ENABLE | B2 |
| BP2 | B3 |
| +16 5V | B4 |
| PWRBUS | B5 |
| TRC2/ECGI | B6 |
| TRC1/ECGII | B7 |
| RESP/ECGV | B8 |
| NC | B9 |
| BP4 | B10 |
| GND | B11 |
| +5V | B12 |
| NC | B13 |
| NC | B14 |
| AGND | B15 |

| A2J5 | | A1J2 |
|---|---|---|
| 1 | ART BP | 1 |
| | SYNC ECG RTN | 2 |
| 3 | BP2 | 3 |
| 4 | SYNC ECG(10MV/V) | 4 |
| 5 | BP3 | 5 |
| 6 | BP4 | 6 |
| 7 | TRC2/ECGI | 7 |
| 8 | TRC1/ECGII | 8 |
| 9 | RESP/ECGV | |
| 10 | SPARE | 10 |
| 11 | SPARE | 11 |
| 12 | AGND | 12 |
| 13 | -12 8 ANALOG | 13 |
| 14 | AGND | 14 |
| 1 | +12 8 ANALOG | 15 |
| 1 | +5 0 ANALOG | 16 |
| 17 | 5 0 RTN | 17 |
| 18 | -5 0 ANALOG | 18 |
| 19 | 5 0 RTN | 19 |
| 20 | XMIT EN* | 20 |
| 21 | MOD ENABLE | 21 |
| 22 | MOD DATA CLK* | 22 |
| 23 | MOD DATA IN | 23 |
| 24 | GND | 24 |
| 25 | MOD DATA OUT | 25 |
| 26 | GND | 26 |
| 27 | MOD DATA LCH* | 27 |
| 28 | BKPLANE ID | 28 |
| 29 | +5V | 29 |
| 30 | +5V BOOT | 30 |
| 31 | +5V | 31 |
| 32 | SPARE | 32 |
| 33 | +15 5V | 33 |
| 34 | PWRRTN | 34 |
| 35 | PWRRTN | 35 |
| 36 | +16 5V | 36 |
| 37 | +16 5V | 37 |
| 38 | SPARE | 38 |
| 39 | PWRBUS | 39 |
| 40 | PWRBUS | 40 |

W1P1 W1P2

| A3J3 | | A2J2 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRBUS | 2 |
| 3 | +16 5V | 3 |
| 4 | +16 5V | 4 |
| 5 | PWRRTN | 5 |
| 6 | PWRRTN | 6 |
| 7 | DLK RXD+ | 7 |
| 8 | DLK RXD- | 8 |
| 9 | DLK TXD+ | 9 |
| 10 | DLK TXD- | 10 |
| 11 | DSYNC OUT | 11 |
| 12 | GND | 12 |
| 13 | MARKER RTN | 13 |
| 14 | GND | 14 |
| 15 | SPARE | 15 |
| 16 | SPARE | 16 |
| 17 | DSYNC ECG | 17 |
| 18 | AGND | 18 |
| 19 | BUF ART BP | 19 |
| 20 | AGND | 20 |

W2P2

| A7J1 | | |
|---|---|---|
| 1 | PWR LED | 21 |
| 2 | SPARE | 22 |
| 3 | SPARE | 23 |
| 4 | GND | 24 |

W2P3 W2P1

| | | |
|---|---|---|
| 1 | NC | 1 |
| 2 | NC | 2 |
| 3 | NC | 3 |
| 4 | GND | 4 |
| 5 | NC | 5 |
| 6 | GND | 6 |
| 7 | NC | 7 |
| 8 | GND | 8 |
| 9 | NC | 9 |
| 10 | NC | 10 |
| 11 | NC | 11 |
| 12 | GND | 12 |
| 13 | NC | 13 |
| 14 | NC | 14 |
| 15 | NC | 15 |
| 16 | NC | 16 |
| 17 | NC | 17 |
| 18 | NC | 18 |
| 19 | NC | 19 |
| 20 | NC | 20 |
| 21 | NC | 21 |
| 22 | GND | 22 |
| 23 | NC | 23 |
| 24 | GND | 24 |
| 25 | NC | 25 |
| 26 | GND | 26 |
| 27 | OPER/TEST* | 27 |
| 28 | PA7 | 28 |
| 29 | SLOW/FAST* | 29 |
| 30 | PA6 | 30 |
| 31 | GND | 31 |
| 32 | PA5 | 32 |
| 33 | GND | 33 |
| 34 | PA4 | 34 |
| 35 | PAR/LCD* | 35 |
| 36 | PA3 | 36 |
| 37 | GND | 37 |
| 38 | PA2 | 38 |
| 39 | GND | 39 |
| 40 | PA1 | 40 |
| 41 | MINX RESET* | 41 |
| 42 | PA0 | 42 |
| 43 | PULSE | 43 |
| 44 | OBF* | 44 |
| 45 | INT DET | 45 |
| 46 | ACK* | 46 |
| 47 | CALIB OK | 47 |
| 48 | IBF | 48 |
| 49 | SPARE | 49 |
| 50 | STB* | 50 |
| 51 | LQS | 51 |
| 52 | NC | 52 |
| 53 | NO PRB | 53 |
| 54 | RXD* | 54 |
| 55 | PRB OFF | 55 |
| 56 | NC | 56 |
| 57 | LO SAT | 57 |
| 58 | +5 0 ANALOG | 58 |
| 59 | 5 0 RTN | 59 |
| 60 | -5 0 ANALOG | 60 |
| 61 | +5V | 61 |
| 62 | +5V | 62 |
| 63 | GND | 63 |
| 64 | GND | 64 |

A4J1 A2J1

| | | |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRRTN | 2 |
| 3 | PWRBUS | 3 |
| 4 | PWRRTN | 4 |
| 5 | NIBP P7 | 5 |
| 6 | SPARE | 6 |
| 7 | NIBP P6 | 7 |
| 8 | +5V | 8 |
| 9 | NIBP P5 | 9 |
| 10 | GND | 10 |
| 11 | NIBP P4 | 11 |
| 12 | FAN ENBL* | 12 |
| 13 | NIBP P3 | 13 |
| 14 | NIBP ENBL* | 14 |
| 15 | NIBP P2 | 15 |
| 16 | NIBP IO* | 16 |
| 17 | NIBP P1 | 17 |
| 18 | NIBP RD* | 18 |
| 19 | NIBP P0 | 19 |
| 20 | NIBP WR* | 20 |
| 21 | NIBP SEL0 | 21 |
| 22 | NIBP SEL1 | 22 |

A2 4 A5J1

| | | |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRBUS | 2 |
| 3 | PWRRTN | 3 |
| 4 | PWRRTN | 4 |
| 5 | SPARE | 5 |
| 6 | SPARE | 6 |
| 7 | GND | 7 |
| 8 | DAS GTXD | 8 |
| 9 | GND | 9 |
| 10 | DAS GRXD | 10 |
| 11 | +5V | 11 |
| 12 | DAS GDEN* | 12 |
| 13 | +5V | 13 |
| 14 | DAS ENBL* | 14 |

A9J2 A2J3

| | | |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRRTN | 2 |
| 3 | PWRBUS | 3 |
| 4 | PWRRTN | 4 |
| 5 | NIBP P7 | 5 |
| 6 | SPARE | 6 |
| 7 | NIBP P6 | 7 |
| 8 | +12V SW | 8 |
| 9 | NIBP P5 | 9 |
| 10 | +12V SW | 10 |
| 11 | NIBP P4 | 11 |
| 12 | SPARE | 12 |
| 13 | NIBP P3 | 13 |
| 14 | NIBP ENBL* | 14 |
| 15 | NIBP P2 | 15 |
| 16 | NIBP IO* | 16 |
| 17 | NIBP P1 | 17 |
| 18 | NIBP RD* | 18 |
| 19 | NIBP P0 | 19 |
| 20 | NIBP WR* | 20 |
| 21 | NIBP SEL0 | 21 |
| 22 | NIBP SEL1 | 22 |
| 23 | GND | 23 |
| 24 | +5V | 24 |

A5J3 A8P3

# Parts List PN 411024-001J

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 1 | | Cover, Module | 400895-001 | 1 |
| 2 | | Frame | 400982-001 | 1 |
| 3 | | Shield, Top | 401679-001 | 1 |
| 4 | | Shield, Bottom | 401679-002 | 1 |
| 5 | A9 | 800 Acquisition Module, 10-Lead | 417123-001 | 1 |
| 6 | | Front Bezel, Lower | 401105-004 | 1 |
| 7 | A5 | Fan PCB | 403549-002 | 1 |
| 8 | | Trim, Rubber, Front Bezel | 404620-001 | 1 |
| 9 | | Mounting Strap, Trim | 404621-001 | 1 |
| 10 | A1 | Power Supply PCB | 401309-002 | 1 |
| 12 | A2 | Module Processor PCB | 800210-005 | 1 |
| 13 | | Circuit Board/Bezel Mount | 404762-001 | 1 |
| 14 | | Shield, Pulse Oximetry PCB | 401680-001 | 1 |
| 15 | | Plate, Chassis Ground, Bottom/Front | 402317-001 | 1 |
| 16 | A4 | Pulse Oximetry PCB | 401189-001 | 1 |
| 17 | | Plate, Chassis Ground, Rear | 404680-002 | 1 |
| 19 | | Spring, Compression | 402315-001 | 2 |
| 20 | | Screw, Power Supply PCB Mounting, SST, 4-40 | 402214-001 | 4 |
| 21 | | Label, Model/Serial Number | 404525-006 | 1 |
| 22 | A7 | Power Indicator PCB | 403170-008 | 1 |
| 23 | | Spring, Chassis Ground, Rear | 403741-001 | AR |
| 24 | | Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16 | 4505-406 | 6 |
| 25 | | Nut, Hex, 4-40 | 4521-304 | 2 |
| 26 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 45074-406 | 17 |
| 27 | | Screw, BDGH, Phillips, 4-40 x 1-3/8 | 45074-438 | 2 |
| 28 | | Spacer, Male/Female, 4-40 x 0.875 | 4656-414 | 2 |
| 29 | | Screw, 4-40 x 7/8 | 404069-001 | 2 |
| 30 | A3 | Non-Isolated Input PCB | 401315-002 | 1 |
| 31 | | Carton, Shipping | 404211-003 | 1 |
| 32 | | Foam Insert | 404211-004 | 2 |
| 33 | | Screw, BDGH, Phillips, 4-40 x 5/8 | 45074-420 | 2 |
| 34 | | Screw, BDGH, Phillips, 4-40 x 3/4 | 45074-424 | 4 |
| 35 | A6 | Interconnect PCB | 800006-001 | 1 |
| 36 | | Insulator, Bottom Shield | 404188-001 | 2 |
| 38 | | Screw, BDGH, Phillips, 4-40 x 3/8 | 45074-412 | 2 |
| 39 | | Washer, Pulse Oximetry Connector | 4550-250 | 1 |
| 40 | | Screw, FLH, Phillips, SST, 4-40 x 3/8 | 4505-412 | 2 |
| 41 | | Tram 100 - 850 A and SL Modules Service Manual | 404422-065 | AR |
| 42 | | Adhesive, Diecut, Front Right | 415098-010 | 1 |

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 43 | | Screw, PHD, 4-40 x 0.188, Modified (Determined by Destination) | 409009-001 | 1 |
| 43 | | Screw, PHD, 4-40 x 0.188, (Determined by Destination) | 45074-406 | 1 |
| 44 | | Harness Assembly, SpO2 – w/Choke | 700091-004 | 1 |
| 45 | | Pin, Latch | 402806-001 | 0 |
| 47 | | Button, Latch | 402106-001 | 2 |
| 48 | | Latch | 401682-001 | 2 |
| 49 | | Spring, Latch | 406019-001 | 2 |
| 50 | | Pin, Latch | 406037-001 | 2 |
| 51 | | Bracket, Power Supply PCB | 406254-001 | 1 |
| 52 | B1 | Pump Assembly, NBP, w/Harness | 408169-002 | 1 |
| 53 | A10 | NBP Valve Assembly | 416153-001 | 1 |
| 54 | A8 | NBP PCB | 800316-002 | 1 |
| 55 | | Bracket, NBP Mounting | 404296-001 | 1 |
| 56 | | Check Valve, 0.125 ID | 404675-001 | 1 |
| 57 | | Tubing, Silastic | 401582-001 | AR |
| 58 | | Filter, 43 Micron | 404679-001 | 1 |
| 59 | | Grommet, 1/4 Dia, 1/8 High, 1/16 Panel Thickness | 404749-001 | 5 |
| 60 | | Tie Wrap | 4535-002 | 1 |
| 63 | | Screw, PNH, Phillips, SST, 4-40 x 3/16 | 4502-406 | 2 |
| 67 | | SpO2 Sensor, Adult, Finger, Package of 6 | 411667-001 | 1 |
| 68 | | Label, Front, 800SL, English (Determined by Destination) | 411091-002 | 1 |
| 68 | | Label, Front, 800SL, German (Determined by Destination) | 411091-003 | 1 |
| 68 | | Label, Front, 800SL, French (Determined by Destination) | 411091-004 | 1 |
| 68 | | Label, Front, 800SL Swedish (Determined by Destination) | 411091-005 | 1 |
| 68 | | Label, Front, 800SL, Spanish (Determined by Destination) | 411091-006 | 1 |
| 68 | | Label, Front, 800SL, Italian (Determined by Destination) | 411091-007 | 1 |
| 68 | | Label, Front, 800SL, Dutch (Determined by Destination) | 411091-008 | 1 |
| 69 | | Label, Top, English (Determined by Destination) | 411091-009 | 1 |
| 69 | | Label, Top, German (Determined by Destination) | 411091-010 | 1 |
| 69 | | Label, Top, French (Determined by Destination) | 411091-011 | 1 |
| 69 | | Label, Top, Swedish (Determined by Destination) | 411091-012 | 1 |
| 69 | | Label, Top, Spanish (Determined by Destination) | 411091-013 | 1 |
| 69 | | Label, Top, Italian (Determined by Destination) | 411091-014 | 1 |
| 69 | | Label, Top, Dutch (Determined by Destination) | 411091-015 | 1 |
| 70 | | Label, 60 Hertz (Determined by Destination) | 411091-018 | 1 |
| 70 | | Label, 50 Hertz (Determined by Destination) | 411091-019 | 1 |
| 71 | | Label, Cover, English (Determined by Destination) | 411091-016 | 1 |

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 71 | | Label, Cover, German (Determined by Destination) | 411091-020 | 1 |
| 71 | | Label, Cover, French (Determined by Destination) | 411091-021 | 1 |
| 71 | | Label, Cover, Swedish (Determined by Destination) | 411091-022 | 1 |
| 71 | | Label, Cover, Spanish (Determined by Destination) | 411091-023 | 1 |
| 71 | | Label, Cover, Italian (Determined by Destination) | 411091-024 | 1 |
| 71 | | Label, Cover, International (Determined by Destination) | 411091-025 | 1 |
| 72 | | Label, TUV (Determined by Destination) | 408103-003 | 1 |
| 72 | | Label, UL Listed (Determined by Destination) | 408230-002 | 1 |
| 73 | P1 | Connector, Header, 64-Pin, w/Ferrites | 409203-001 | 1 |
| 74 | | Adhesive, Diecut, Front Left | 415098-002 | 1 |
| 76 | | Spring, Chassis Ground, Small | 414610-001 | AR |
| 77 | | Adhesive, Mylar | 415316-001 | 1 |
| 78 | | Label, CE Mark | 408230-008 | 1 |
| 79 | | PC Post, 2 x 7 | 412062-004 | 1 |
| 80 | | PC Post, 2 x 11 | 412062-005 | 1 |

# Assembly Revisions PN 411024

The baseline revision for this assembly is pn 411024-001J. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

## PN 411024-001B

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 5 | A9 | DAS 800SL Module, 10-Lead | 411025-001 | 417123-001 | 1 |
| 11 | | Label Set, Tram 800SL | 411091-001 | Not Used | 1 |
| 12 | | Module Processor PCB | 800210-002 | 800210-005 | 1 |
| 42 | | Adhesive, Loctite Prism 411 | 4851-082 | 415098-001 | AR |
| 53 | A6 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 54 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |
| 63 | | Screw, Phillips, STT, 4-40 x 3/16 | Not Used | 4502-406 | 2 |
| 73 | | Connector, Header 64-pin w/Ferrites | Not Used | 409203-001 | 1 |
| 74 | | Adhesive, Diecut Front Left | Not Used | 415098-002 | 1 |
| 76 | | Spring, Chassis Ground, Small | Not Used | 414610-001 | AR |
| 77 | | Adhesive, Mylar | Not Used | 415316-001 | 1 |
| 78 | | Label, CE Mark | Not Used | 408230-008 | 1 |
| 79 | | PC Post, 2 x 7 | Not Used | 412062-004 | 1 |
| 80 | | PC Post, 2 x 11 | Not Used | 412062-005 | 1 |

## PN 411024-001C

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 5 | A9 | DAS 800SL Module, 10-Lead | 411025-001 | 417123-001 | 1 |
| 12 | | Module Processor PCB | 800210-002 | 800210-005 | 1 |
| 53 | A6 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 54 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |
| 42 | | Adhesive, Loctite Prism 411 | 4851-082 | 415098-001 | AR |
| 74 | | Adhesive, Diecut Front Left | Not Used | 415098-002 | 1 |
| 76 | | Spring, Chassis Ground, Small | Not Used | 414610-001 | AR |
| 77 | | Adhesive, Mylar | Not Used | 415316-001 | 1 |
| 78 | | Label, CE Mark | Not Used | 408230-008 | 1 |
| 79 | | PC Post, 2 x 7 | Not Used | 412062-004 | 1 |
| 80 | | PC Post, 2 x 11 | Not Used | 412062-005 | 1 |

## PN 411024-001D

This revision was a documentation change that does not affect this manual.
Refer to pn 411024-001C for changes to the parts list.

## PN 411024-001E

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 5 | A9 | DAS 800SL Module, 10-Lead | 411025-001 | 417123-001 | 1 |
| 12 |  | Module Processor PCB | 800210-002 | 800210-005 | 1 |
| 53 | A6 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 54 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |
| 76 |  | Spring, Chassis Ground, Small | Not Used | 414610-001 | AR |
| 77 |  | Adhesive, Mylar | Not Used | 415316-001 | 1 |
| 78 |  | Label, CE Mark | Not Used | 408230-008 | 1 |
| 79 |  | PC Post, 2 x 7 | Not Used | 412062-004 | 1 |
| 80 |  | PC Post, 2 x 11 | Not Used | 412062-005 | 1 |

## PN 411024-001F

This revision was a documentation change that does not affect this manual.
Refer to pn 411024-001E for changes to the parts list.

## PN 411024-001G

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 5 | A9 | DAS 800SL Module, 10-Lead | 411025-001 | 417123-001 | 1 |
| 53 | A6 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 54 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |

## PN 411024-001H

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 5 | A9 | DAS 800SL Module, 10-Lead | 411025-001 | 417123-001 | 1 |
| 54 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |

# 16 TRAM 850A/SL MODULE PN 412657/412658

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**Parts List PN 412658-001H** ............................................................ **16-16**

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# General

## Circuit Boards

Details about the circuit boards contained in the Tram 850A/SL are discussed in later chapters arranged by part number.

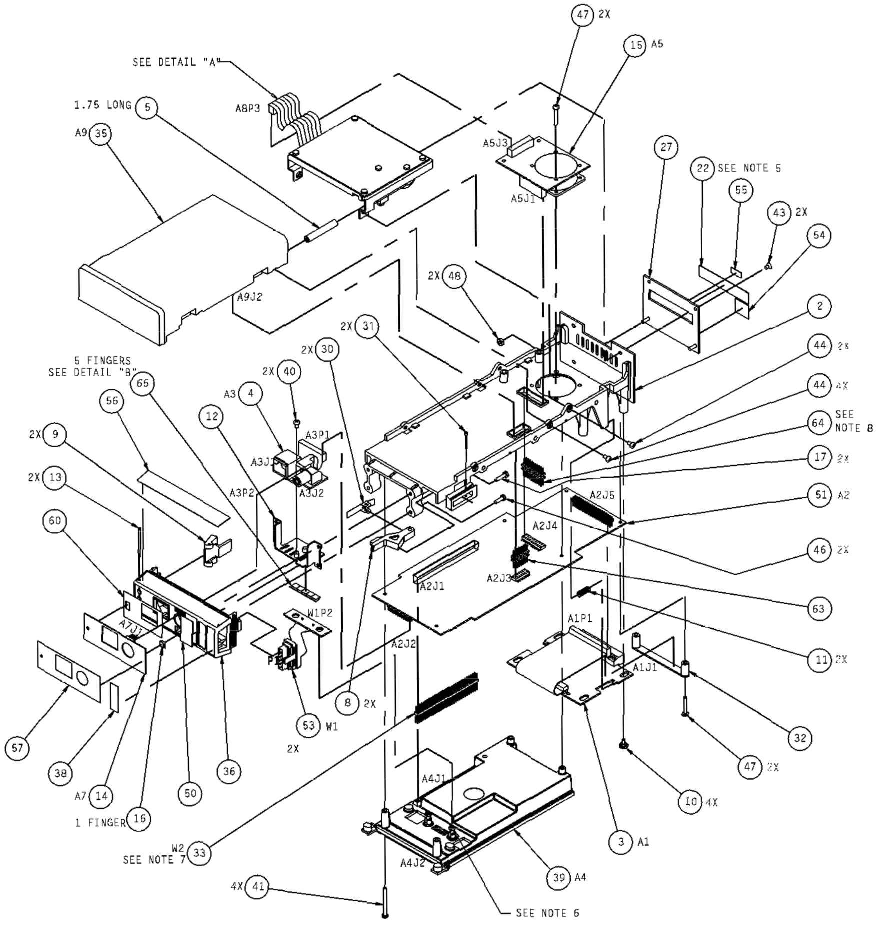
**Table 15-1. Circuit Board Overview**

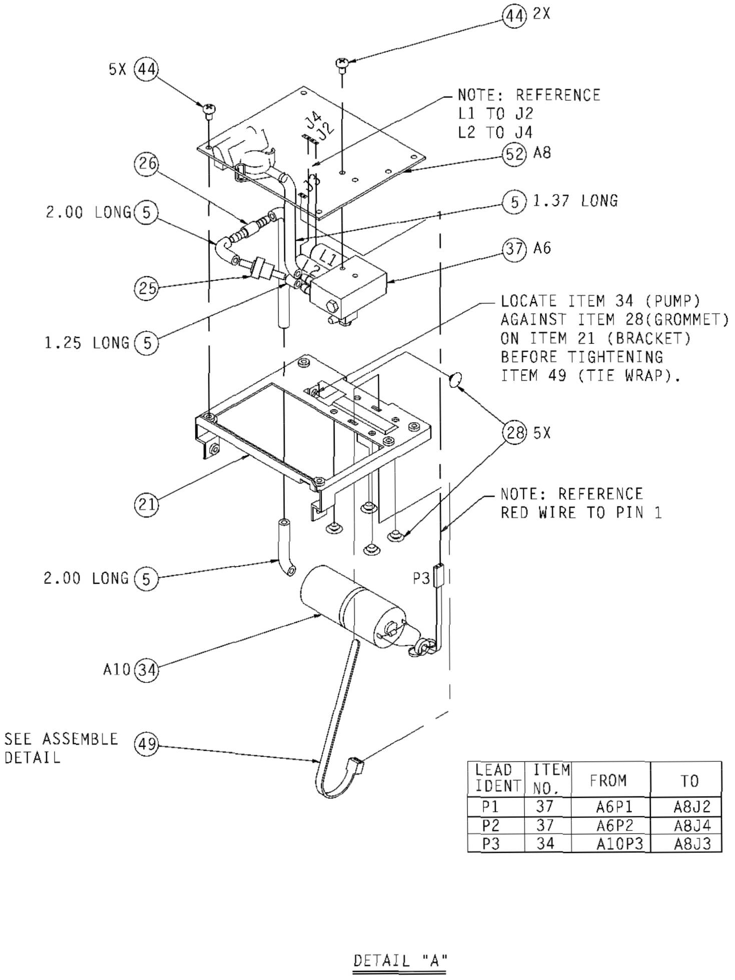
| Module Type | Upper Level | Leadwire Configuration | DAS Module | Acquisition Processor PCB | Module Processor PCB |
|---|---|---|---|---|---|
| Tram 850A | 412657-001A–G | 5-Leadwire | 411068-001 | 800330-011 | 800210-005 |
| Tram 850A | 412657-001H | 5-Leadwire | 417124-001<br>(Replaces 411068-001) | 801040-001 | 800210-005 |
| Tram 850SL | 412658-001A–G | 10-Leadwire | 411025-001 | 800330-012 | 800210-005 |
| Tram 850SL | 412658-001H | 10-Leadwire | 417123-001<br>(Replaces 411025-001) | 801040-001 | 800210-005 |

# Exploded View

# PN 412657-001H

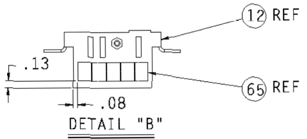
1 of 2


SEE DETAIL "A"
1.75 LONG (5)
A9 (35)
A8P3
A9J2
A5J3
A5J1
(47) 2X
(15) A5
(27)
(22) SEE NOTE 5
(55)
(43) 2X
(54)
(2)
2X (48)
2X (31)
2X (30)
2X (40)
A3 (4)
(12)
5 FINGERS
SEE DETAIL "B"
(65)
(56)
2X (9)
2X (13)
(60)
A3P1
A3J1
A3J2
A3P2
(44) 2X
(44) 4X
(64) SEE NOTE 8
(17) 2X
(51) A2
(46) 2X
(63)
(11) 2X
A2J5
A2J4
A2J3
A2J1
A2J2
A1P1
A1J1
W1P2
(32)
(47) 2X
(10) 4X
(3) A1
(39) A4
SEE NOTE 6
A4J1
A4J2
4X (41)
W2
SEE NOTE 7 (33)
(8) 2X
(53) W1
2X
(57)
(38)
A7 (14)
1 FINGER (16)
(50)
(36)
A7J1


(44) 2X
5X (44)
NOTE: REFERENCE
L1 TO J2
L2 TO J4
J4
J2
L1
L2
(52) A8
(5) 1.37 LONG
(37) A6
(26)
2.00 LONG (5)
(25)
1.25 LONG (5)
LOCATE ITEM 34 (PUMP)
AGAINST ITEM 28(GROMMET)
ON ITEM 21 (BRACKET)
BEFORE TIGHTENING
ITEM 49 (TIE WRAP).
(28) 5X
(21)
NOTE: REFERENCE
RED WIRE TO PIN 1
2.00 LONG (5)
P3
A10 (34)
SEE ASSEMBLE
DETAIL
(49)

| LEAD IDENT | ITEM NO. | FROM | TO |
|---|---|---|---|
| P1 | 37 | A6P1 | A8J2 |
| P2 | 37 | A6P2 | A8J4 |
| P3 | 34 | A10P3 | A8J3 |

DETAIL "A"

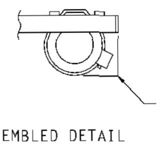

(12) REF
(65) REF
.13
.08

DETAIL "B"

(LOCATE APPROXIMATELY AS SHOWN)
(BOTTOM VIEW OF ITEM 12)

NOTES:

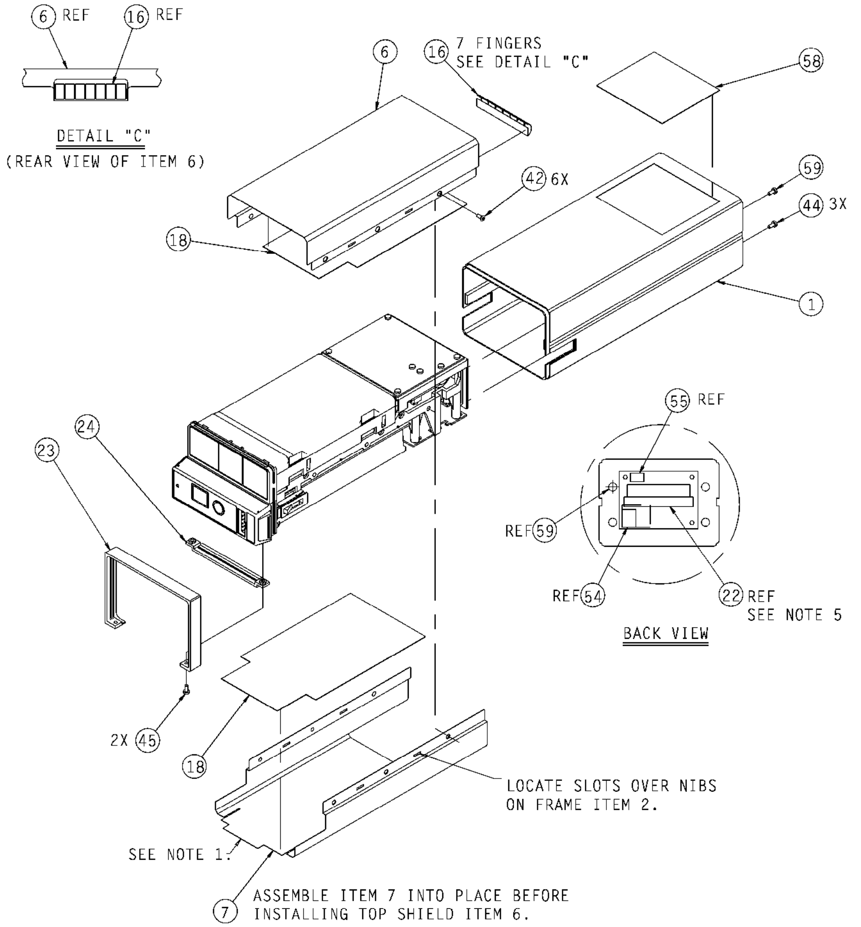
1. WHEN SHIELD (ITEM 7) IS INSTALLED, THE TAB SHOULD TUCK INTO THE FRONT BEZEL (ITEM 36) AND BE IN CONTACT WITH THE SHIELDING FINGERS (ITEM 16) ON THE BOTTOM OF THE BRACKET (ITEM 12).
2. SWITCH SETTINGS MUST BE MADE FOR EACH CONFIGURATION (SEE SWITCH CHART SHEET 2).
3. CHECK APPROPRIATE BOX ON SIDE OF CARTON TO INDICATE UNIT BEING SHIPPED.
4. LOOSE ITEMS MAY BE SHIPPED WITH THE UNIT IF SPACE PERMITS OR PACKAGED AND SHIPPED SEPARATELY.
5. MARK LABEL WITH MODEL NUMBER, SERIAL NUMBER, AND BAR CODE.
6. INSERT TWO HOLES OF FLEX PCB (ITEM 53) ONTO 1/4-TURN STANDOFF (ITEM 39) UNTIL CONNECTOR ON PCB FLEX BOTTOMS OUT. THEN LOCK THE STANDOFFS BY TURNING THE HEX SCREW OF THE STANDOFF 1/4-TURN CLOCKWISE.
7. INSERT THE SHORT LEADS OF CONNECTOR (ITEM 33) INTO PCB TRAM CPU (ITEM 51).
8. INSERT LONGER PIN SIDE INTO ITEM 51. PINS MUST EXTEND BEYOND MATING CONNECTOR ON ITEM 51 WHEN ASSEMBLED.

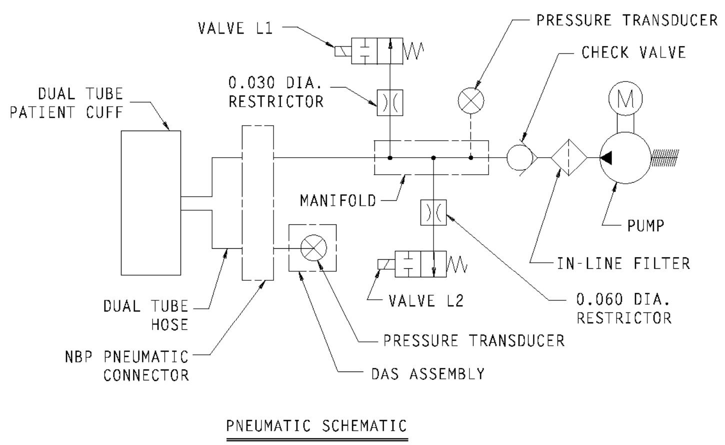


ASSEMBLED DETAIL

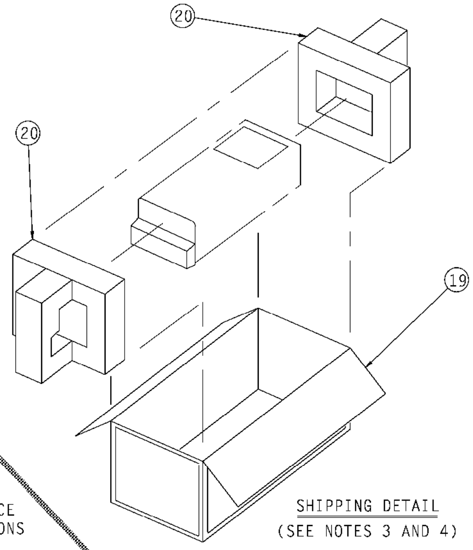
NOTE: HEAD OF TIE WRAP ITEM 49 MUST NOT BREAK EITHER OF THESE PLANES AFTER ASSEMBLY.

2 of 2


6 REF
16 REF
DETAIL "C"
(REAR VIEW OF ITEM 6)
6
16 7 FINGERS SEE DETAIL "C"
58
42 6X
59
44 3X
18
1
23
24
55 REF
REF 59
REF 54
22 REF SEE NOTE 5
BACK VIEW
2X 45
18
LOCATE SLOTS OVER NIBS ON FRAME ITEM 2.
SEE NOTE 1.
7 ASSEMBLE ITEM 7 INTO PLACE BEFORE INSTALLING TOP SHIELD ITEM 6.


VALVE L1
PRESSURE TRANSDUCER
CHECK VALVE
0.030 DIA. RESTRICTOR
DUAL TUBE PATIENT CUFF
M
MANIFOLD
PUMP
IN-LINE FILTER
VALVE L2
0.060 DIA. RESTRICTOR
DUAL TUBE HOSE
PRESSURE TRANSDUCER
NBP PNEUMATIC CONNECTOR
DAS ASSEMBLY

PNEUMATIC SCHEMATIC

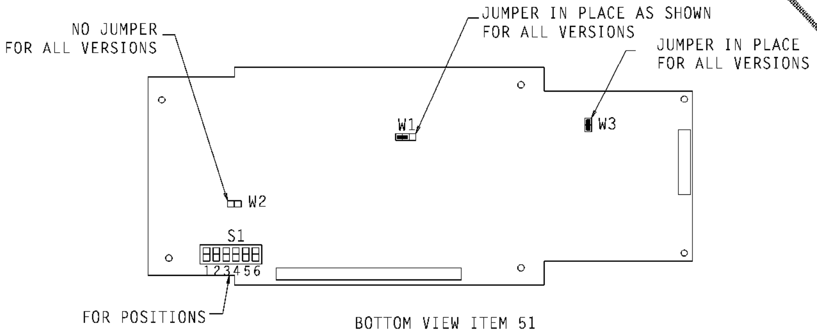


SHIPPING DETAIL
(SEE NOTES 3 AND 4)

SWITCH CHART
(SEE NOTE 2)

▀ =ON
▄ =OFF

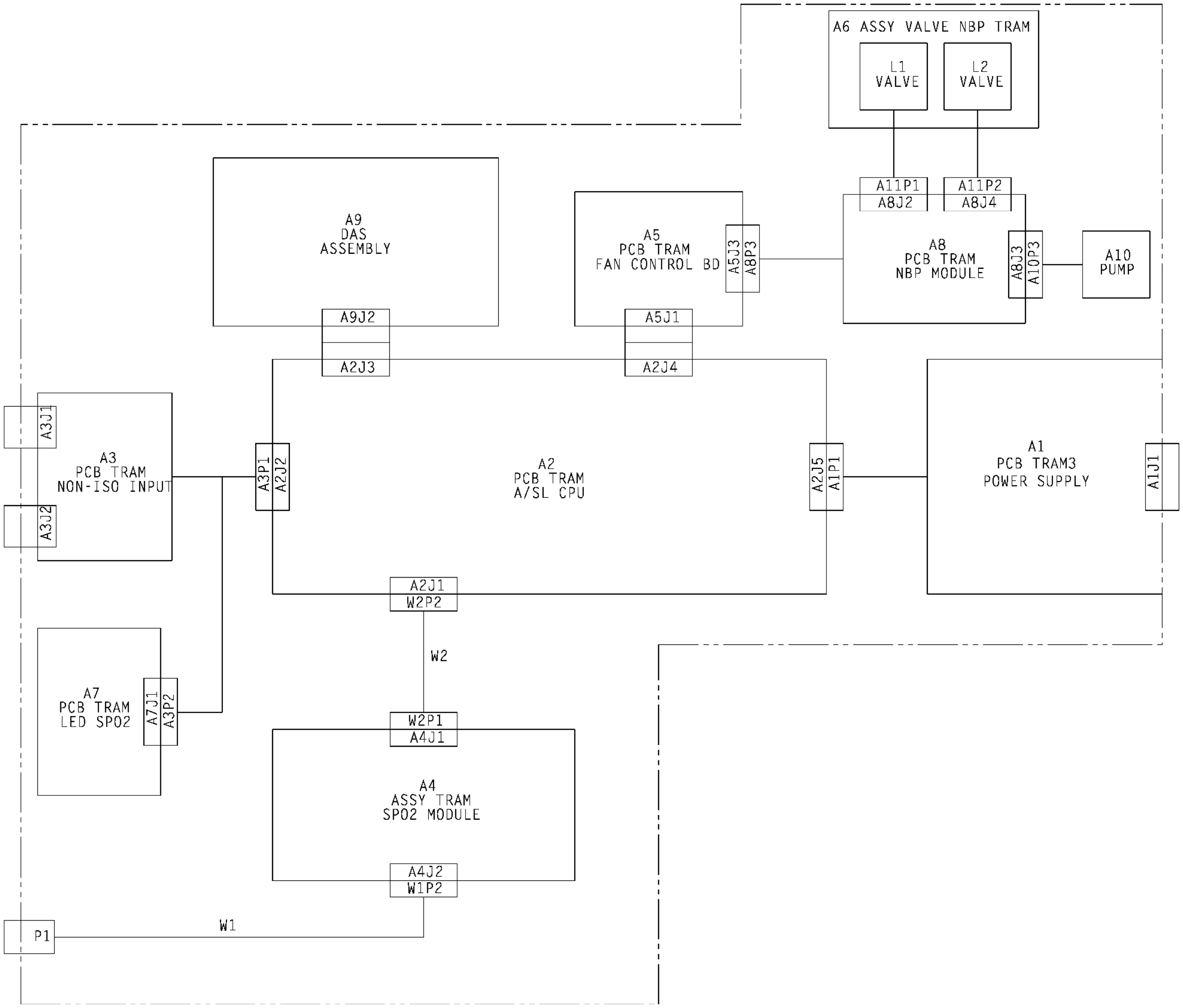
| DESCRIPTION | SW1<br>123456 | OMAR NUMBER | |
|---|---|---|---|
| ENG 60HZ | ▄▄▄▄▄▄ | T250<br>T450<br>T850<br>T850SL | =A,G |
| ENG 50HZ | ▄▄▄▄▄▀ | T250<br>T450<br>T850<br>T850SL | =A5 |
| SI 60HZ | ▄▄▄▄▀▄ | T250<br>T450<br>T850<br>T850SL | =Q |
| SI 50HZ | ▄▄▄▄▀▀ | T250<br>T450<br>T850<br>T850SL | =S,H,<br>T,J,<br>P,W |

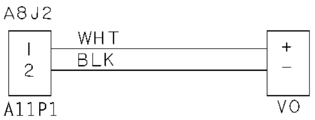

NO JUMPER FOR ALL VERSIONS
JUMPER IN PLACE AS SHOWN FOR ALL VERSIONS
JUMPER IN PLACE FOR ALL VERSIONS
W1
W3
W2
S1
123456
FOR POSITIONS SEE SWITCH CHART

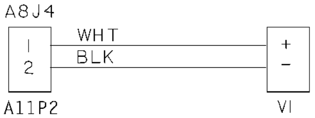
BOTTOM VIEW ITEM 51

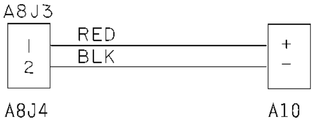
# Schematic Diagram PN 412657-001H

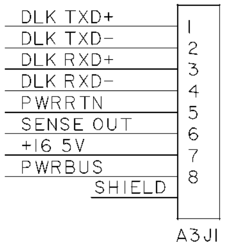
1 of 2

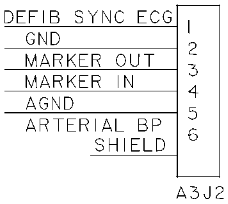

A6 ASSY VALVE NBP TRAM
L1 VALVE
L2 VALVE
A11P1
A8J2
A11P2
A8J4
A9 DAS ASSEMBLY
A5 PCB TRAM FAN CONTROL BD
A5J3
A8P3
A8 PCB TRAM NBP MODULE
A8J3
A10P3
A10 PUMP
A9J2
A2J3
A5J1
A2J4
A3J1
A3 PCB TRAM NON-ISO INPUT
A3J2
A3P1
A2J2
A2 PCB TRAM A/SL CPU
A2J5
A1P1
A1 PCB TRAM3 POWER SUPPLY
A1J1
A2J1
W2P2
W2
A7 PCB TRAM LED SPO2
A7J1
A3P2
W2P1
A4J1
A4 ASSY TRAM SPO2 MODULE
A4J2
W1P2
P1
W1

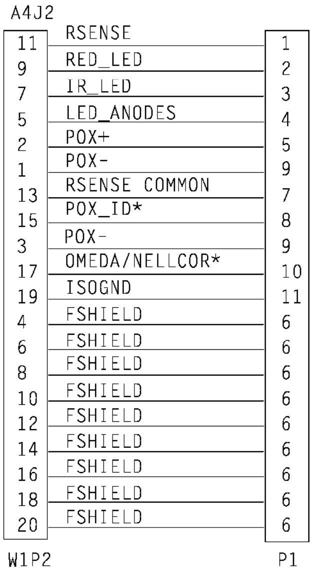

A8J2
1
2
WHT
BLK
+
−
A11P1
VO


A8J4
1
2
WHT
BLK
+
−
A11P2
VI

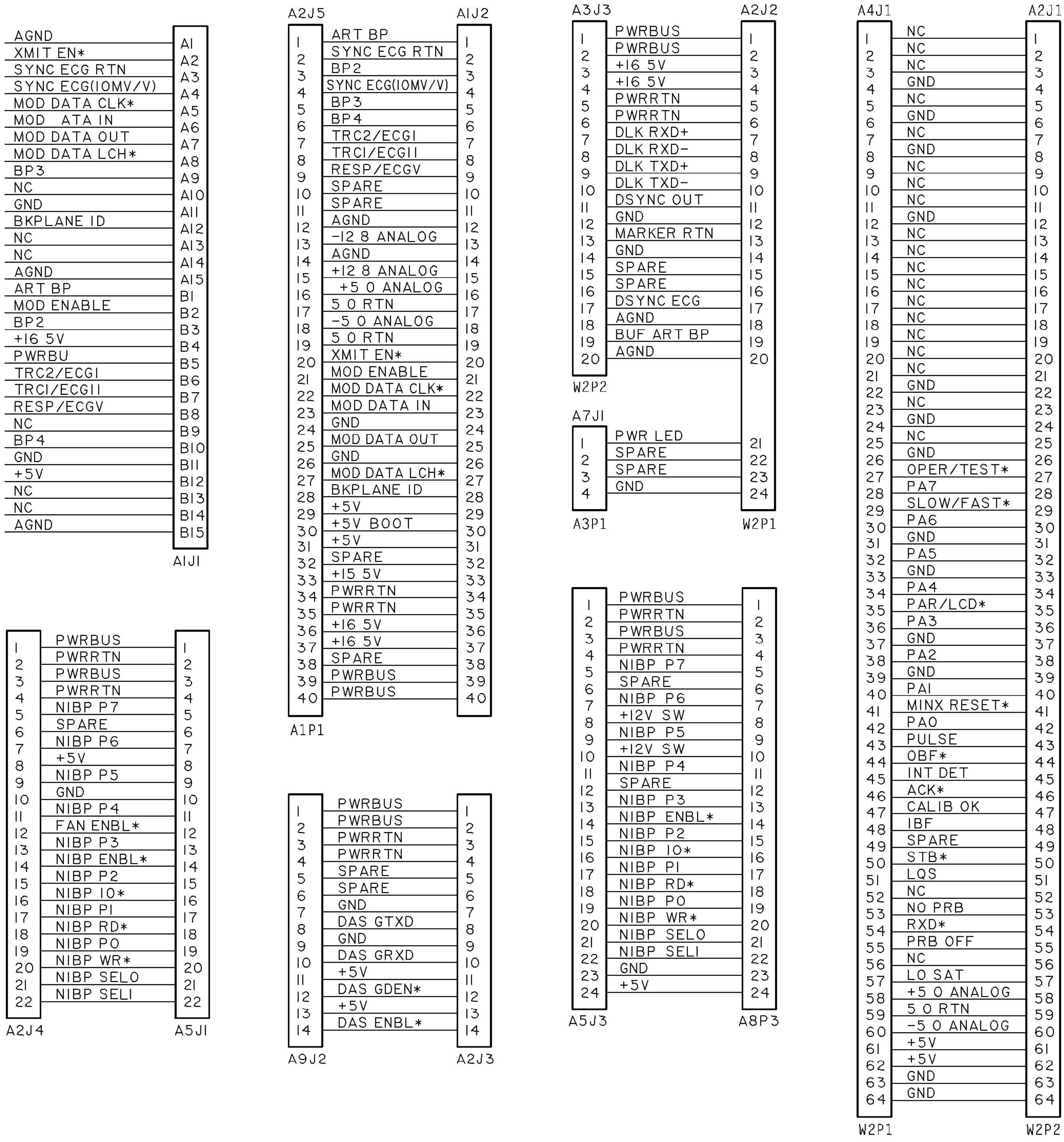

A8J3
1
2
RED
BLK
+
−
A8J4
A10


DLK TXD+ 1
DLK TXD− 2
DLK RXD+ 3
DLK RXD− 4
PWRRTN 5
SENSE OUT 6
+16.5V 7
PWRBUS 8
SHIELD
A3J1


DEFIB SYNC ECG 1
GND 2
MARKER OUT 3
MARKER IN 4
AGND 5
ARTERIAL BP 6
SHIELD
A3J2


A4J2
11 RSENSE 1
9 RED_LED 2
7 IR_LED 3
5 LED_ANODES 4
2 POX+ 5
1 POX- 9
13 RSENSE COMMON 7
15 POX_ID* 8
3 POX- 9
17 OMEDA/NELLCOR* 10
19 ISOGND 11
4 FSHIELD 6
6 FSHIELD 6
8 FSHIELD 6
10 FSHIELD 6
12 FSHIELD 6
14 FSHIELD 6
16 FSHIELD 6
18 FSHIELD 6
20 FSHIELD 6
W1P2
P1

**2 of 2**



| Signal | A1J1 |
|---|---|
| AGND | A1 |
| XMIT EN* | A2 |
| SYNC ECG RTN | A3 |
| SYNC ECG(10MV/V) | A4 |
| MOD DATA CLK* | A5 |
| MOD ATA IN | A6 |
| MOD DATA OUT | A7 |
| MOD DATA LCH* | A8 |
| BP3 | A9 |
| NC | A10 |
| GND | A11 |
| BKPLANE ID | A12 |
| NC | A13 |
| NC | A14 |
| AGND | A15 |
| ART BP | B1 |
| MOD ENABLE | B2 |
| BP2 | B3 |
| +16 5V | B4 |
| PWRBU | B5 |
| TRC2/ECGI | B6 |
| TRC1/ECGII | B7 |
| RESP/ECGV | B8 |
| NC | B9 |
| BP4 | B10 |
| GND | B11 |
| +5V | B12 |
| NC | B13 |
| NC | B14 |
| AGND | B15 |

| A2J5 (A1P1) | Signal | A1J2 |
|---|---|---|
| 1 | ART BP | 1 |
| 2 | SYNC ECG RTN | 2 |
| 3 | BP2 | 3 |
| 4 | SYNC ECG(10MV/V) | 4 |
| 5 | BP3 | 5 |
| 6 | BP4 | 6 |
| 7 | TRC2/ECGI | 7 |
| 8 | TRC1/ECGII | 8 |
| 9 | RESP/ECGV | 9 |
| 10 | SPARE | 10 |
| 11 | SPARE | 11 |
| 12 | AGND | 12 |
| 13 | -12 8 ANALOG | 13 |
| 14 | AGND | 14 |
| 15 | +12 8 ANALOG | 15 |
| 16 | +5 0 ANALOG | 16 |
| 17 | 5 0 RTN | 17 |
| 18 | -5 0 ANALOG | 18 |
| 19 | 5 0 RTN | 19 |
| 20 | XMIT EN* | 20 |
| 21 | MOD ENABLE | 21 |
| 22 | MOD DATA CLK* | 22 |
| 23 | MOD DATA IN | 23 |
| 24 | GND | 24 |
| 25 | MOD DATA OUT | 25 |
| 26 | GND | 26 |
| 27 | MOD DATA LCH* | 27 |
| 28 | BKPLANE ID | 28 |
| 29 | +5V | 29 |
| 30 | +5V BOOT | 30 |
| 31 | +5V | 31 |
| 32 | SPARE | 32 |
| 33 | +15 5V | 33 |
| 34 | PWRRTN | 34 |
| 35 | PWRRTN | 35 |
| 36 | +16 5V | 36 |
| 37 | +16 5V | 37 |
| 38 | SPARE | 38 |
| 39 | PWRBUS | 39 |
| 40 | PWRBUS | 40 |

| A3J3 (W2P2) | Signal | A2J2 (W2P1) |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRBUS | 2 |
| 3 | +16 5V | 3 |
| 4 | +16 5V | 4 |
| 5 | PWRRTN | 5 |
| 6 | PWRRTN | 6 |
| 7 | DLK RXD+ | 7 |
| 8 | DLK RXD- | 8 |
| 9 | DLK TXD+ | 9 |
| 10 | DLK TXD- | 10 |
| 11 | DSYNC OUT | 11 |
| 12 | GND | 12 |
| 13 | MARKER RTN | 13 |
| 14 | GND | 14 |
| 15 | SPARE | 15 |
| 16 | SPARE | 16 |
| 17 | DSYNC ECG | 17 |
| 18 | AGND | 18 |
| 19 | BUF ART BP | 19 |
| 20 | AGND | 20 |

| A7J1 (A3P1) | Signal | A2J2 (W2P1) |
|---|---|---|
| 1 | PWR LED | 21 |
| 2 | SPARE | 22 |
| 3 | SPARE | 23 |
| 4 | GND | 24 |

| A4J1 (W2P1) | Signal | A2J1 (W2P2) |
|---|---|---|
| 1 | NC | 1 |
| 2 | NC | 2 |
| 3 | NC | 3 |
| 4 | GND | 4 |
| 5 | NC | 5 |
| 6 | GND | 6 |
| 7 | NC | 7 |
| 8 | GND | 8 |
| 9 | NC | 9 |
| 10 | NC | 10 |
| 11 | NC | 11 |
| 12 | GND | 12 |
| 13 | NC | 13 |
| 14 | NC | 14 |
| 15 | NC | 15 |
| 16 | NC | 16 |
| 17 | NC | 17 |
| 18 | NC | 18 |
| 19 | NC | 19 |
| 20 | NC | 20 |
| 21 | NC | 21 |
| 22 | GND | 22 |
| 23 | NC | 23 |
| 24 | GND | 24 |
| 25 | NC | 25 |
| 26 | GND | 26 |
| 27 | OPER/TEST* | 27 |
| 28 | PA7 | 28 |
| 29 | SLOW/FAST* | 29 |
| 30 | PA6 | 30 |
| 31 | GND | 31 |
| 32 | PA5 | 32 |
| 33 | GND | 33 |
| 34 | PA4 | 34 |
| 35 | PAR/LCD* | 35 |
| 36 | PA3 | 36 |
| 37 | GND | 37 |
| 38 | PA2 | 38 |
| 39 | GND | 39 |
| 40 | PA1 | 40 |
| 41 | MINX RESET* | 41 |
| 42 | PA0 | 42 |
| 43 | PULSE | 43 |
| 44 | OBF* | 44 |
| 45 | INT DET | 45 |
| 46 | ACK* | 46 |
| 47 | CALIB OK | 47 |
| 48 | IBF | 48 |
| 49 | SPARE | 49 |
| 50 | STB* | 50 |
| 51 | LQS | 51 |
| 52 | NC | 52 |
| 53 | NO PRB | 53 |
| 54 | RXD* | 54 |
| 55 | PRB OFF | 55 |
| 56 | NC | 56 |
| 57 | LO SAT | 57 |
| 58 | +5 0 ANALOG | 58 |
| 59 | 5 0 RTN | 59 |
| 60 | -5 0 ANALOG | 60 |
| 61 | +5V | 61 |
| 62 | +5V | 62 |
| 63 | GND | 63 |
| 64 | GND | 64 |

| A2J4 | Signal | A5J1 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRRTN | 2 |
| 3 | PWRBUS | 3 |
| 4 | PWRRTN | 4 |
| 5 | NIBP P7 | 5 |
| 6 | SPARE | 6 |
| 7 | NIBP P6 | 7 |
| 8 | +5V | 8 |
| 9 | NIBP P5 | 9 |
| 10 | GND | 10 |
| 11 | NIBP P4 | 11 |
| 12 | FAN ENBL* | 12 |
| 13 | NIBP P3 | 13 |
| 14 | NIBP ENBL* | 14 |
| 15 | NIBP P2 | 15 |
| 16 | NIBP IO* | 16 |
| 17 | NIBP P1 | 17 |
| 18 | NIBP RD* | 18 |
| 19 | NIBP P0 | 19 |
| 20 | NIBP WR* | 20 |
| 21 | NIBP SEL0 | 21 |
| 22 | NIBP SEL1 | 22 |

| A9J2 | Signal | A2J3 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRBUS | 2 |
| 3 | PWRRTN | 3 |
| 4 | PWRRTN | 4 |
| 5 | SPARE | 5 |
| 6 | SPARE | 6 |
| 7 | GND | 7 |
| 8 | DAS GTXD | 8 |
| 9 | GND | 9 |
| 10 | DAS GRXD | 10 |
| 11 | +5V | 11 |
| 12 | DAS GDEN* | 12 |
| 13 | +5V | 13 |
| 14 | DAS ENBL* | 14 |

| A5J3 | Signal | A8P3 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRRTN | 2 |
| 3 | PWRBUS | 3 |
| 4 | PWRRTN | 4 |
| 5 | NIBP P7 | 5 |
| 6 | SPARE | 6 |
| 7 | NIBP P6 | 7 |
| 8 | +12V SW | 8 |
| 9 | NIBP P5 | 9 |
| 10 | +12V SW | 10 |
| 11 | NIBP P4 | 11 |
| 12 | SPARE | 12 |
| 13 | NIBP P3 | 13 |
| 14 | NIBP ENBL* | 14 |
| 15 | NIBP P2 | 15 |
| 16 | NIBP IO* | 16 |
| 17 | NIBP P1 | 17 |
| 18 | NIBP RD* | 18 |
| 19 | NIBP P0 | 19 |
| 20 | NIBP WR* | 20 |
| 21 | NIBP SEL0 | 21 |
| 22 | NIBP SEL1 | 22 |
| 23 | GND | 23 |
| 24 | +5V | 24 |

# Parts List PN 412657-001H

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 1 | | Cover, Module | 400895-001 | 1 |
| 2 | | Frame | 400982-001 | 1 |
| 3 | A1 | Power Supply PCB Assembly | 401309-002 | 1 |
| 4 | A3 | Non-Isolated Input PCB Assembly | 401315-002 | 1 |
| 5 | | Tubing, Silastic | 401582-001 | AR |
| 6 | | Shield, Top | 401679-001 | 1 |
| 7 | | Shield, Bottom | 401679-002 | 1 |
| 8 | | Latch | 401682-001 | 2 |
| 9 | | Button, Latch | 402106-001 | 2 |
| 10 | | Screw, Shoulder | 402214-001 | 4 |
| 11 | | Spring, Compression | 402315-001 | 2 |
| 12 | | Plate, Chassis Ground, Bottom/Front | 402317-001 | 1 |
| 13 | | Pin, Latch | 402806-001 | 2 |
| 14 | A7 | Power Indicator PCB | 403170-011 | 1 |
| 15 | A5 | Fan PCB | 403549-002 | 1 |
| 16 | | Spring, Chassis Ground, Rear | 403741-001 | AR |
| 17 | | Screw, BDGH, Phillips, 4-40 x 7/8 | 404069-001 | 2 |
| 18 | | Insulator, Bottom Shield | 404188-001 | 2 |
| 19 | | Carton, Shipping | 404211-003 | 1 |
| 20 | | Foam, Insert | 404211-004 | 1 |
| 21 | | Bracket, NBP Mounting | 404296-001 | 1 |
| 22 | | Label, Blank | 404525-006 | 1 |
| 23 | | Trim, Rubber, Front Bezel | 404620-001 | 1 |
| 24 | | Mounting Strap, Trim | 404621-001 | 1 |
| 25 | | Check Valve, 0.125 ID | 404675-001 | 1 |
| 26 | | Filter, 43 Micron | 404679-001 | 1 |
| 27 | | Plate, Chassis Ground, Rear | 404680-002 | 1 |
| 28 | | Grommet, 1/4 Dia, 1/8 High, 1/16 Panel Thickness | 404749-001 | 5 |
| 30 | | Spring, Latch | 406019-001 | 2 |
| 31 | | Pin, Latch | 406037-001 | 2 |
| 32 | | Bracket, Power Supply PCB | 406254-001 | 1 |
| 33 | W2 | Connector, Header, Dual, 64-Pin | 407452-002 | 1 |
| 34 | A10 | Pump Assembly, NBP, w/Harness | 408169-002 | 1 |
| 35 | A9 | 800 Acquisition Module, 5-Lead | 417124-001 | 1 |
| 36 | | Front Bezel, Tram | 412659-001 | 1 |
| 37 | A6 | NBP Valve Assembly | 416153-001 | 1 |
| 38 | | Label, Pulse Oximetry, Nellcor (Determined by Destination) | 413831-002 | 1 |
| 39 | A4 | Pulse Oximetry Assembly (Including Pulse Oximetry PCB, PN 800674-00X) | 414409-001 | 1 |
| 40 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 4502-406 | 2 |

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 41 | | Screw, BDGH, Phillips, 4-40 x 1-1/4 | 4502-440 | 4 |
| 42 | | Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16 | 4505-406 | 6 |
| 43 | | Screw, FLH, Phillips, SST, 4-40 x 3/8 | 4505-412 | 2 |
| 44 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 45074-406 | 15 |
| 45 | | Screw, BDGH, Phillips, 4-40 x 3/8 | 45074-412 | 2 |
| 46 | | Screw, BDGH, Phillips, 4-40 x 5/8 | 45074-420 | 2 |
| 47 | | Screw, BDGH, Phillips, 4-40 x 3/4 | 45074-424 | 4 |
| 48 | | Nut, Hex, 4-40 | 4521-304 | 2 |
| 49 | | Tie Wrap | 4535-002 | 1 |
| 50 | | Adhesive, Diecut, Front Right | 415098-003 | AR |
| 51 | A2 | Module Processor PCB | 800210-005 | 1 |
| 52 | A8 | NPB PCB | 800316-002 | 1 |
| 53 | W1 | Harness, Pulse Oximetry PCB-to-Connector | 800892-001 | 1 |
| 54 | | Label, UL Listed (Determined by Destination) | 40230-003 | 1 |
| 55 | | Label, 60 Hertz (Determined by Destination) | 411091-018 | 1 |
| 55 | | Label, 50 Hertz (Determined by Destination) | 411091-019 | 1 |
| 56 | | Label, Top, English (Determined by Destination) | 411091-009 | 1 |
| 56 | | Label, Top, German (Determined by Destination) | 411091-010 | 1 |
| 56 | | Label, Top, French (Determined by Destination) | 411091-011 | 1 |
| 56 | | Label, Top, Swedish (Determined by Destination) | 411091-012 | 1 |
| 56 | | Label, Top, Spanish (Determined by Destination) | 411091-013 | 1 |
| 56 | | Label, Top, Italian (Determined by Destination) | 411091-014 | 1 |
| 56 | | Label, Top, Dutch (Determined by Destination) | 411091-015 | 1 |
| 57 | | Label, Front, 850A, English (Determined by Destination) | 413841-001 | 1 |
| 57 | | Label, Front, 850A, German (Determined by Destination) | 413841-002 | 1 |
| 57 | | Label, Front, 850A, French (Determined by Destination) | 413841-003 | 1 |
| 57 | | Label, Front, 850A, Swedish (Determined by Destination) | 413841-004 | 1 |
| 57 | | Label, Front, 850A, Spanish (Determined by Destination) | 413841-005 | 1 |
| 57 | | Label, Front, 850A, Italian (Determined by Destination) | 413841-006 | 1 |
| 57 | | Label, Front, 850A, Dutch (Determined by Destination) | 413841-007 | 1 |
| 58 | | Label, Cover, English (Determined by Destination) | 414051-001 | 1 |
| 58 | | Label, Cover, German (Determined by Destination) | 414051-002 | 1 |
| 58 | | Label, Cover, French (Determined by Destination) | 414051-003 | 1 |
| 58 | | Label, Cover, Swedish (Determined by Destination) | 414051-004 | 1 |
| 58 | | Label, Cover, Spanish (Determined by Destination) | 414051-005 | 1 |
| 58 | | Label, Cover, Italian (Determined by Destination) | 414051-006 | 1 |
| 58 | | Label, Cover, International (Determined by Destination) | 414051-007 | 1 |

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 59 | | Screw, PHD, 4-40 x 0.188, Modified (Determined byDestination) | 409009-001 | 1 |
| 59 | | Screw, PHD, 4-40 x 0.188 (Determined by Destination) | 45074-406 | 1 |
| 60 | | Adhesive, Diecut, Front Left | 415098-002 | 1 |
| 61 | | Tram 100 - 850 A and SL Module Service Manual | 404422-065 | 1 |
| 62 | | Label, CE Mark | 408230-008 | 1 |
| 63 | | PC Post, 2 x 7 | 412062-004 | 1 |
| 64 | | PC Post, 2 x 11 | 412062-005 | 1 |
| 65 | | Spring, Chassis Ground, Small | 414610-001 | AR |

# Assembly Revisions PN 412657

The baseline revision for this assembly is pn 412657-001H. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

## PN 412657-001A

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 35 | A9 | DAS 800A Module, 5-Lead | 411068-001 | 417124-001 | 1 |
| 37 | A6 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 50 |  | Adhesive, Loctite Prism 411 | 4851-082 | 415098-001 | AR |
| 51 |  | Module Processor PCB | 800210-002 | 800210-005 | 1 |
| 52 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |
| 59 |  | Spring, Chassis Ground, Small | Not Used | 414610-001 | AR |
| 60 |  | Adhesive, Diecut Front Left | Not Used | 415098-002 | 1 |
| 62 |  | Label, CE Mark | Not Used | 408230-008 | 1 |
| 63 |  | PC Post, 2 x 7 | Not Used | 412062-004 | 1 |
| 64 |  | PC Post, 2 x 11 | Not Used | 412062-005 | 1 |

## PN 412657-001B

This revision was a documentation change that does not affect this manual.
Refer to pn 412657-001A for changes to the parts list.

## PN 412657-001C

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 35 | A9 | DAS 800A Module, 5-Lead | 411068-001 | 417124-001 | 1 |
| 37 | A6 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 51 |  | Module Processor PCB | 800210-002 | 800210-005 | 1 |
| 52 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |
| 62 |  | Label, CE Mark | Not Used | 408230-008 | 1 |
| 63 |  | PC Post, 2 x 7 | Not Used | 412062-004 | 1 |
| 64 |  | PC Post, 2 x 11 | Not Used | 412062-005 | 1 |

## PN 412657-001D

This revision was a documentation change that does not affect this manual.
Refer to pn 412657-001C for changes to the parts list.

## PN 412657-001E

This revision was a documentation change that does not affect this manual.
Refer to pn 412657-001C for changes to the parts list.

## PN 412657-001F

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 35 | A9 | DAS 800A Module, 5-Lead | 411068-001 | 417124-001 | 1 |
| 37 | A6 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 52 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |

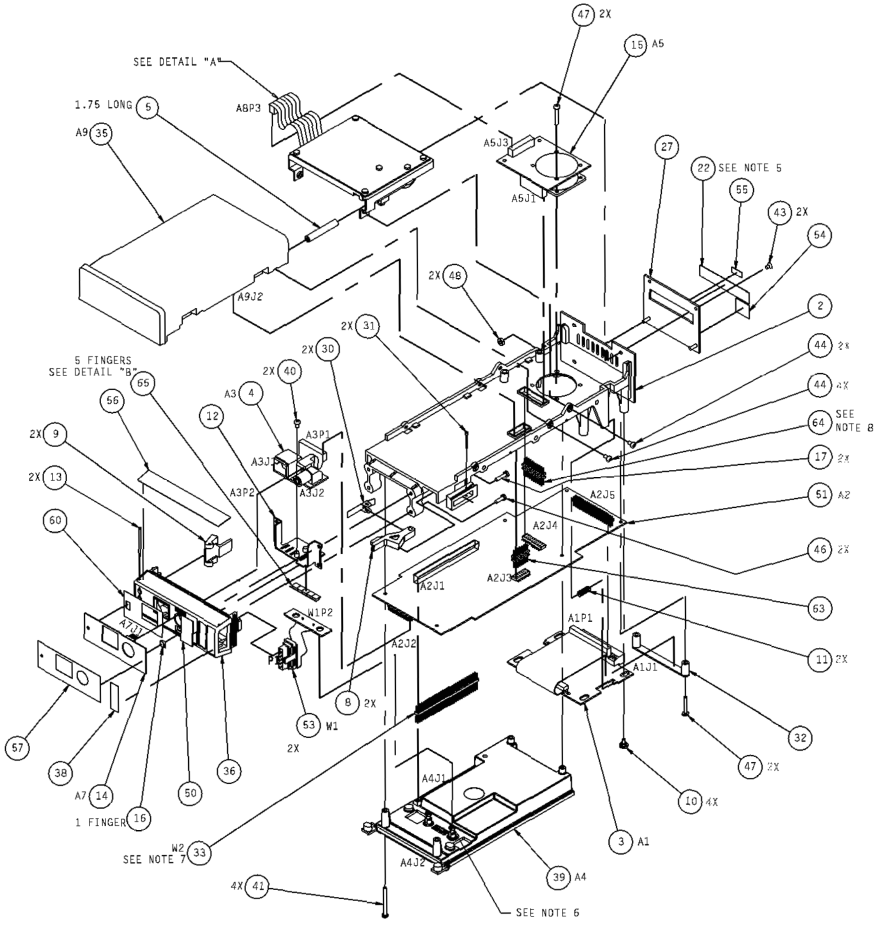
## PN 412657-001G

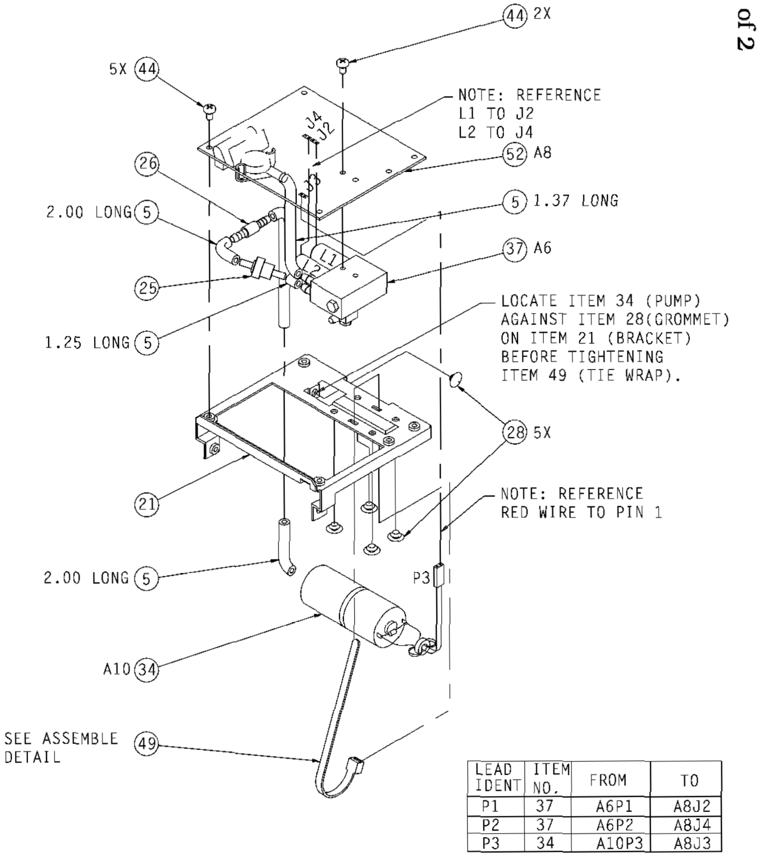
| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 35 | A9 | DAS 800A Module, 5-Lead | 411068-001 | 417124-001 | 1 |
| 52 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |

# Exploded View

# PN 412658-001H

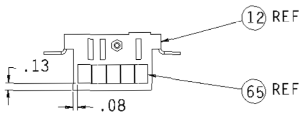
1 of 2


SEE DETAIL "A"
1.75 LONG (5)
A9 (35)
A6P3
A5J3
A5J1
A9J2
(47) 2X
(15) A5
(27)
(22) SEE NOTE 5
(55)
(43) 2X
(54)
(2)
2X (48)
2X (31)
2X (30)
5 FINGERS SEE DETAIL "B"
(65)
(56)
2X (40)
A3 (4)
(12)
A3P1
A3J1
A3J2
A3P2
2X (9)
2X (13)
(60)
(44) 2X
(44) 4X
(64) SEE NOTE 8
(17) 2X
(51) A2
A2J5
A2J4
A2J3
A2J1
A2J2
(46) 2X
(63)
(11) 2X
A1P1
A1J1
W1P2
A7J1
(8) 2X
(53) W1
2X
(32)
(47) 2X
(10) 4X
(3) A1
(57)
(38)
A7 (14)
1 FINGER (16)
(50)
(36)
A4J1
A4J2
(39) A4
W2 SEE NOTE 7 (33)
4X (41)
SEE NOTE 6


(44) 2X
5X (44)
NOTE: REFERENCE
L1 TO J2
L2 TO J4
(52) A8
J4
J2
(26)
2.00 LONG (5)
(5) 1.37 LONG
(37) A6
L1
L2
(25)
1.25 LONG (5)
LOCATE ITEM 34 (PUMP)
AGAINST ITEM 28(GROMMET)
ON ITEM 21 (BRACKET)
BEFORE TIGHTENING
ITEM 49 (TIE WRAP).
(28) 5X
(21)
NOTE: REFERENCE
RED WIRE TO PIN 1
2.00 LONG (5)
P3
A10 (34)
SEE ASSEMBLE DETAIL (49)

| LEAD IDENT | ITEM NO. | FROM | TO |
|---|---|---|---|
| P1 | 37 | A6P1 | A8J2 |
| P2 | 37 | A6P2 | A8J4 |
| P3 | 34 | A10P3 | A8J3 |

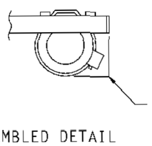
DETAIL "A"


(12) REF
(65) REF
.13
.08

DETAIL "B"

(LOCATE APPROXIMATELY AS SHOWN)
(BOTTOM VIEW OF ITEM 12)

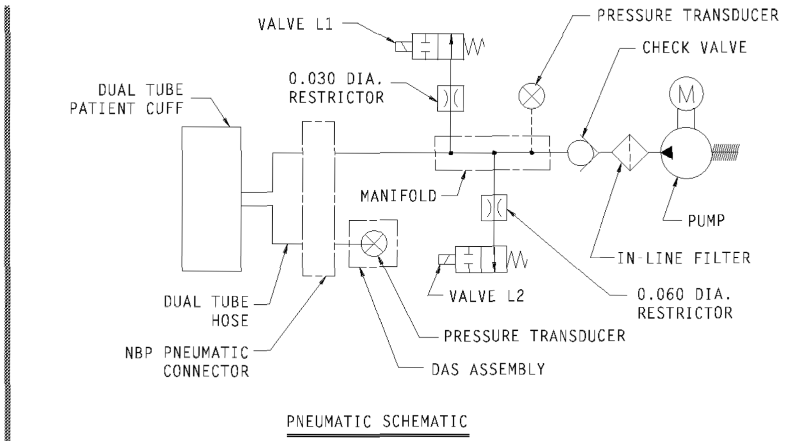
NOTES:
1. WHEN SHIELD (ITEM 7) IS INSTALLED, THE TAB SHOULD TUCK INTO THE FRONT BEZEL (ITEM 36) AND BE IN CONTACT WITH THE SHIELDING FINGERS (ITEM 16) ON THE BOTTOM OF THE BRACKET (ITEM 12).
2. SWITCH SETTINGS MUST BE MADE FOR EACH CONFIGURATION (SEE SWITCH CHART SHEET 2).
3. CHECK APPROPRIATE BOX ON SIDE OF CARTON TO INDICATE UNIT BEING SHIPPED.
4. LOOSE ITEMS MAY BE SHIPPED WITH THE UNIT IF SPACE PERMITS OR PACKAGED AND SHIPPED SEPARATELY.
5. MARK LABEL WITH MODEL NUMBER, SERIAL NUMBER, AND BAR CODE.
6. INSERT TWO HOLES OF FLEX PCB (ITEM 53) ONTO 1/4-TURN STANDOFF (ITEM 39) UNTIL CONNECTOR ON PCB FLEX BOTTOMS OUT. THEN LOCK THE STANDOFFS BY TURNING THE HEX SCREW OF THE STANDOFF 1/4-TURN CLOCKWISE.
7. INSERT THE SHORT LEADS OF CONNECTOR (ITEM 33) INTO PCB TRAM CPU (ITEM 51).
8. INSERT LONGER PIN SIDE INTO ITEM 51. PINS MUST EXTEND BEYOND MATING CONNECTOR ON ITEM 51 WHEN ASSEMBLED.



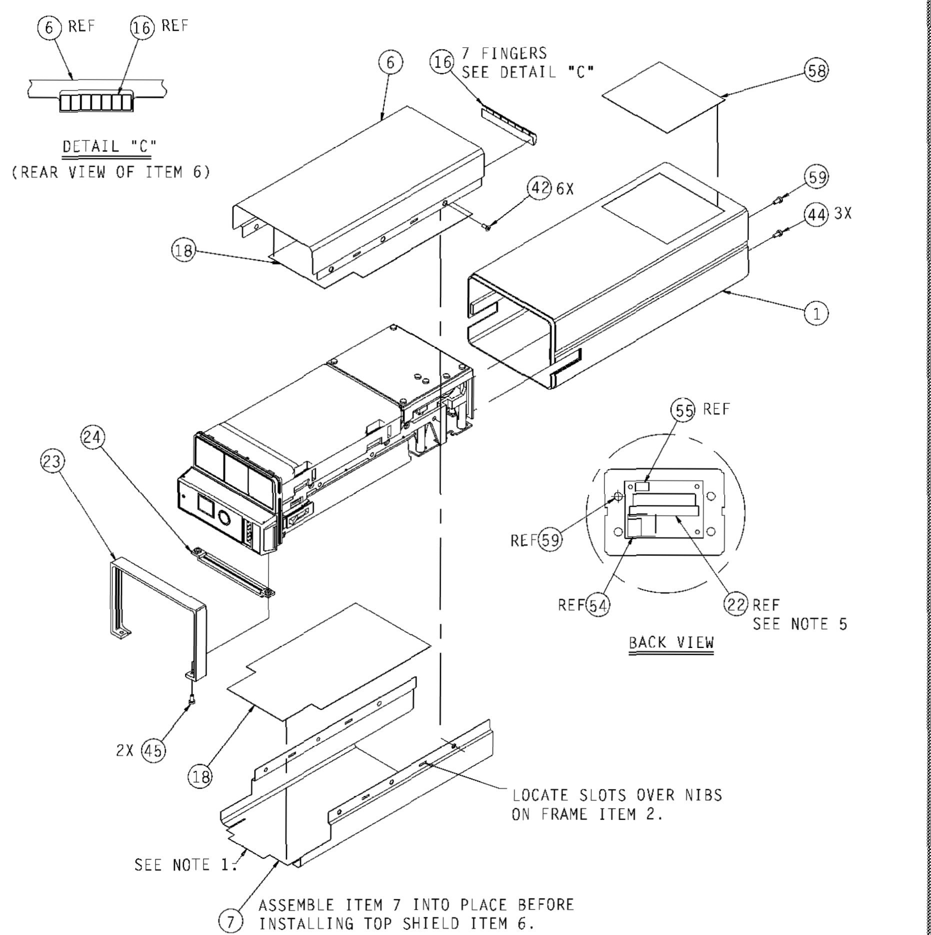
ASSEMBLED DETAIL

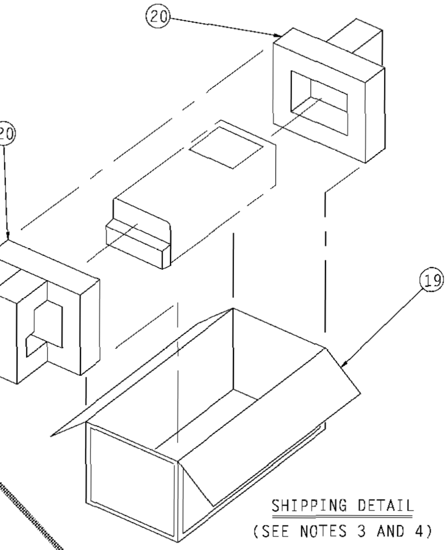
NOTE: HEAD OF TIE WRAP ITEM 49 MUST NOT BREAK EITHER OF THESE PLANES AFTER ASSEMBLY.

2 of 2


VALVE L1
0.030 DIA. RESTRICTOR
DUAL TUBE PATIENT CUFF
PRESSURE TRANSDUCER
CHECK VALVE
M
MANIFOLD
PUMP
IN-LINE FILTER
0.060 DIA. RESTRICTOR
VALVE L2
DUAL TUBE HOSE
PRESSURE TRANSDUCER
NBP PNEUMATIC CONNECTOR
DAS ASSEMBLY

PNEUMATIC SCHEMATIC


6 REF
16 REF
DETAIL "C"
(REAR VIEW OF ITEM 6)
6
16
7 FINGERS SEE DETAIL "C"
58
42 6X
59
44 3X
18
1
55 REF
REF 59
REF 54
22 REF SEE NOTE 5
BACK VIEW
24
23
2X 45
18
LOCATE SLOTS OVER NIBS ON FRAME ITEM 2.
SEE NOTE 1.
7 ASSEMBLE ITEM 7 INTO PLACE BEFORE INSTALLING TOP SHIELD ITEM 6.

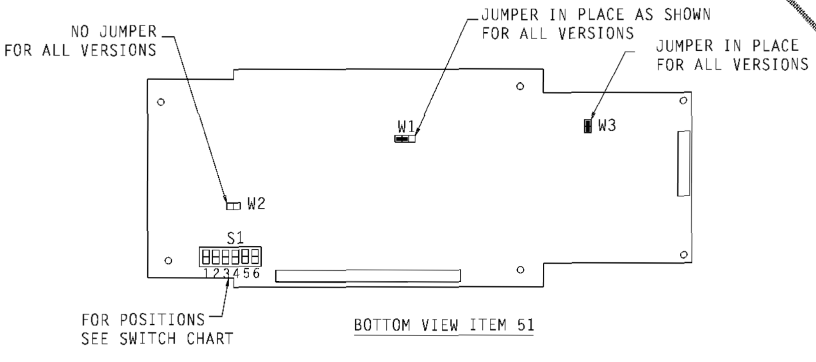


SHIPPING DETAIL
(SEE NOTES 3 AND 4)

SWITCH CHART
(SEE NOTE 2)

▀=ON
▄=OFF

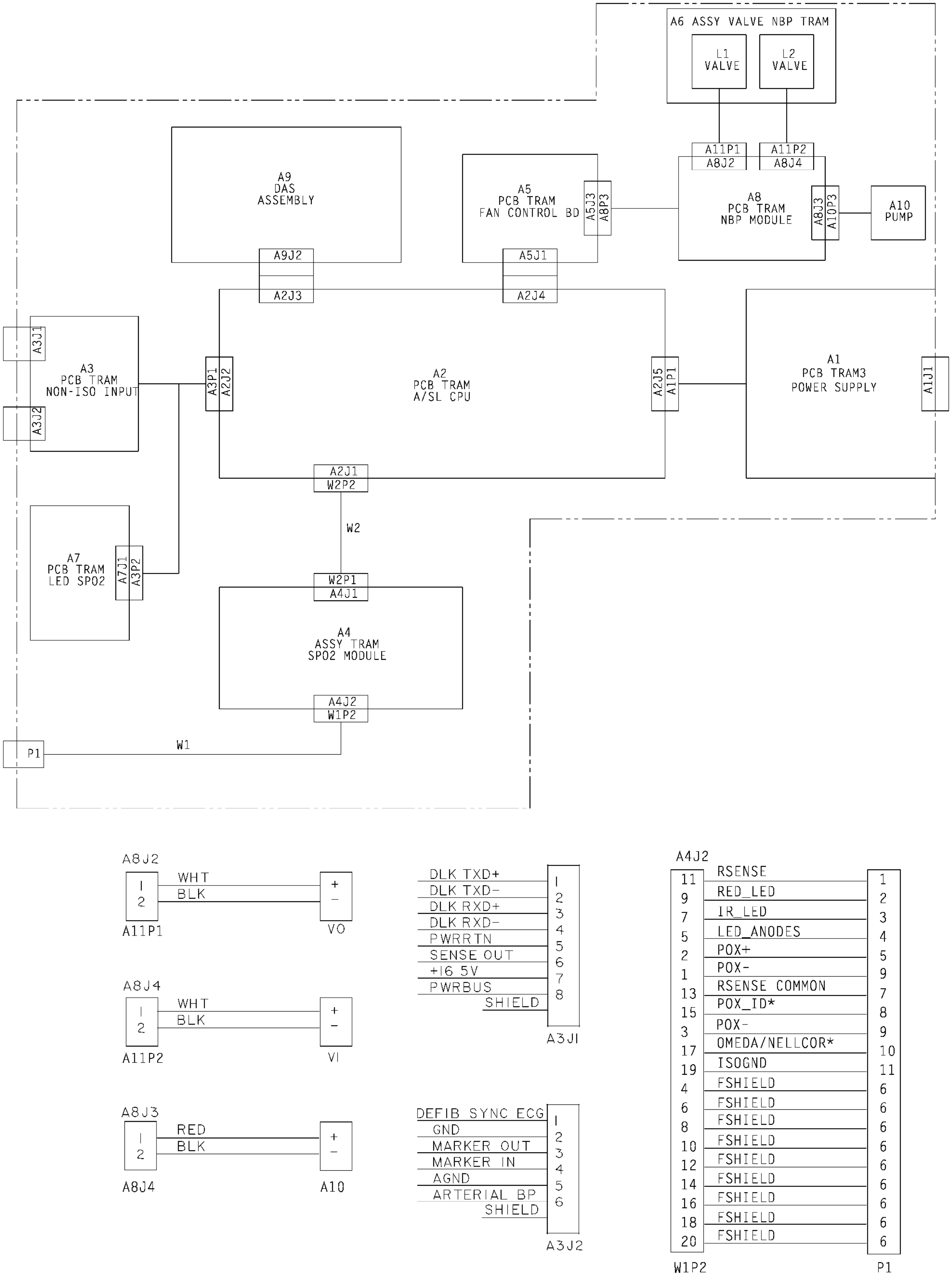
| DESCRIPTION | SW1 | OMAR NUMBER |
|---|---|---|
| ENG 60HZ | ▄▄▄▄▄▄<br>123456 | T250<br>T450<br>T850<br>T850SL =A,G |
| ENG 50HZ | ▄▄▄▄▄▀<br>123456 | T250<br>T450<br>T850<br>T850SL =A5 |
| SI 60HZ | ▄▄▄▄▀▄<br>123456 | T250<br>T450<br>T850<br>T850SL =Q |
| SI 50HZ | ▄▄▄▄▀▀<br>123456 | T250<br>T450<br>T850<br>T850SL =S,H,T,J,P,W |


NO JUMPER FOR ALL VERSIONS
JUMPER IN PLACE AS SHOWN FOR ALL VERSIONS
JUMPER IN PLACE FOR ALL VERSIONS
W1
W3
W2
S1
123456
FOR POSITIONS SEE SWITCH CHART

BOTTOM VIEW ITEM 51

# Schematic Diagram PN 412658-001H

1 of 2


A6 ASSY VALVE NBP TRAM
L1 VALVE
L2 VALVE
A11P1
A8J2
A11P2
A8J4
A9 DAS ASSEMBLY
A9J2
A2J3
A5 PCB TRAM FAN CONTROL BD
A5J3
A8P3
A5J1
A2J4
A8 PCB TRAM NBP MODULE
A8J3
A10P3
A10 PUMP
A3J1
A3 PCB TRAM NON-ISO INPUT
A3J2
A3P1
A2J2
A2 PCB TRAM A/SL CPU
A2J5
A1P1
A1 PCB TRAM3 POWER SUPPLY
A1J1
A2J1
W2P2
W2
W2P1
A4J1
A7 PCB TRAM LED SPO2
A7J1
A3P2
A4 ASSY TRAM SPO2 MODULE
A4J2
W1P2
P1
W1
A8J2
1
2
WHT
BLK
+
−
A11P1
VO
A8J4
1
2
WHT
BLK
+
−
A11P2
VI
A8J3
1
2
RED
BLK
+
−
A8J4
A10
DLK TXD+ 1
DLK TXD− 2
DLK RXD+ 3
DLK RXD− 4
PWRRTN 5
SENSE OUT 6
+16 5V 7
PWRBUS 8
SHIELD
A3J1
DEFIB SYNC ECG 1
GND 2
MARKER OUT 3
MARKER IN 4
AGND 5
ARTERIAL BP 6
SHIELD
A3J2
A4J2
11 RSENSE 1
9 RED_LED 2
7 IR_LED 3
5 LED_ANODES 4
2 POX+ 5
1 POX− 9
13 RSENSE COMMON 7
15 POX_ID* 8
3 POX− 9
17 OMEDA/NELLCOR* 10
19 ISOGND 11
4 FSHIELD 6
6 FSHIELD 6
8 FSHIELD 6
10 FSHIELD 6
12 FSHIELD 6
14 FSHIELD 6
16 FSHIELD 6
18 FSHIELD 6
20 FSHIELD 6
W1P2
P1

**2 of 2**

| | |
|---|---|
| AGND | A1 |
| XMIT EN* | A2 |
| SYNC ECG RTN | A3 |
| SYNC ECG(10MV/V) | A4 |
| MOD DATA CLK* | A5 |
| MOD ATA IN | A6 |
| MOD DATA OUT | A7 |
| MOD DATA LCH* | A8 |
| BP3 | A9 |
| NC | A10 |
| GND | A11 |
| BKPLANE ID | A12 |
| NC | A13 |
| NC | A14 |
| AGND | A15 |
| ART BP | B1 |
| MOD ENABLE | B2 |
| BP2 | B3 |
| +16 5V | B4 |
| PWRBU | B5 |
| TRC2/ECGI | B6 |
| TRCI/ECGII | B7 |
| RESP/ECGV | B8 |
| NC | B9 |
| BP4 | B10 |
| GND | B11 |
| +5V | B12 |
| NC | B13 |
| NC | B14 |
| AGND | B15 |

A1J1

| | | |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRRTN | 2 |
| 3 | PWRBUS | 3 |
| 4 | PWRRTN | 4 |
| 5 | NIBP P7 | 5 |
| 6 | SPARE | 6 |
| 7 | NIBP P6 | 7 |
| 8 | +5V | 8 |
| 9 | NIBP P5 | 9 |
| 10 | GND | 10 |
| 11 | NIBP P4 | 11 |
| 12 | FAN ENBL* | 12 |
| 13 | NIBP P3 | 13 |
| 14 | NIBP ENBL* | 14 |
| 15 | NIBP P2 | 15 |
| 16 | NIBP IO* | 16 |
| 17 | NIBP P1 | 17 |
| 18 | NIBP RD* | 18 |
| 19 | NIBP P0 | 19 |
| 20 | NIBP WR* | 20 |
| 21 | NIBP SEL0 | 21 |
| 22 | NIBP SEL1 | 22 |

A2J4 A5J1

| A2J5 | | A1J2 |
|---|---|---|
| 1 | ART BP | 1 |
| 2 | SYNC ECG RTN | 2 |
| 3 | BP2 | 3 |
| 4 | SYNC ECG(10MV/V) | 4 |
| 5 | BP3 | 5 |
| 6 | BP4 | 6 |
| 7 | TRC2/ECGI | 7 |
| 8 | TRCI/ECGII | 8 |
| 9 | RESP/ECGV | 9 |
| 10 | SPARE | 10 |
| 11 | SPARE | 11 |
| 12 | AGND | 12 |
| 13 | -12 8 ANALOG | 13 |
| 14 | AGND | 14 |
| 15 | +12 8 ANALOG | 15 |
| 16 | +5 0 ANALOG | 16 |
| 17 | 5 0 RTN | 17 |
| 18 | -5 0 ANALOG | 18 |
| 19 | 5 0 RTN | 19 |
| 20 | XMIT EN* | 20 |
| 21 | MOD ENABLE | 21 |
| 22 | MOD DATA CLK* | 22 |
| 23 | MOD DATA IN | 23 |
| 24 | GND | 24 |
| 25 | MOD DATA OUT | 25 |
| 26 | GND | 26 |
| 27 | MOD DATA LCH* | 27 |
| 28 | BKPLANE ID | 28 |
| 29 | +5V | 29 |
| 30 | +5V BOOT | 30 |
| 31 | +5V | 31 |
| 32 | SPARE | 32 |
| 33 | +15 5V | 33 |
| 34 | PWRRTN | 34 |
| 35 | PWRRTN | 35 |
| 36 | +16 5V | 36 |
| 37 | +16 5V | 37 |
| 38 | SPARE | 38 |
| 39 | PWRBUS | 39 |
| 40 | PWRBUS | 40 |

A1P1

| | | |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRBUS | 2 |
| 3 | PWRRTN | 3 |
| 4 | PWRRTN | 4 |
| 5 | SPARE | 5 |
| 6 | SPARE | 6 |
| 7 | GND | 7 |
| 8 | DAS GTXD | 8 |
| 9 | GND | 9 |
| 10 | DAS GRXD | 10 |
| 11 | +5V | 11 |
| 12 | DAS GDEN* | 12 |
| 13 | +5V | 13 |
| 14 | DAS ENBL* | 14 |

A9J2 A2J3

| A3J3 | | A2J2 |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRBUS | 2 |
| 3 | +16 5V | 3 |
| 4 | +16 5V | 4 |
| 5 | PWRRTN | 5 |
| 6 | PWRRTN | 6 |
| 7 | DLK RXD+ | 7 |
| 8 | DLK RXD- | 8 |
| 9 | DLK TXD+ | 9 |
| 10 | DLK TXD- | 10 |
| 11 | DSYNC OUT | 11 |
| 12 | GND | 12 |
| 13 | MARKER RTN | 13 |
| 14 | GND | 14 |
| 15 | SPARE | 15 |
| 16 | SPARE | 16 |
| 17 | DSYNC ECG | 17 |
| 18 | AGND | 18 |
| 19 | BUF ART BP | 19 |
| 20 | AGND | 20 |

W2P2

| A7J1 | | |
|---|---|---|
| 1 | PWR LED | 21 |
| 2 | SPARE | 22 |
| 3 | SPARE | 23 |
| 4 | GND | 24 |

A3P1 W2P1

| | | |
|---|---|---|
| 1 | PWRBUS | 1 |
| 2 | PWRRTN | 2 |
| 3 | PWRBUS | 3 |
| 4 | PWRRTN | 4 |
| 5 | NIBP P7 | 5 |
| 6 | SPARE | 6 |
| 7 | NIBP P6 | 7 |
| 8 | +12V SW | 8 |
| 9 | NIBP P5 | 9 |
| 10 | +12V SW | 10 |
| 11 | NIBP P4 | 11 |
| 12 | SPARE | 12 |
| 13 | NIBP P3 | 13 |
| 14 | NIBP ENBL* | 14 |
| 15 | NIBP P2 | 15 |
| 16 | NIBP IO* | 16 |
| 17 | NIBP P1 | 17 |
| 18 | NIBP RD* | 18 |
| 19 | NIBP P0 | 19 |
| 20 | NIBP WR* | 20 |
| 21 | NIBP SEL0 | 21 |
| 22 | NIBP SEL1 | 22 |
| 23 | GND | 23 |
| 24 | +5V | 24 |

A5J3 A8P3

| A4J1 | | A2J1 |
|---|---|---|
| 1 | NC | 1 |
| 2 | NC | 2 |
| 3 | NC | 3 |
| 4 | GND | 4 |
| 5 | NC | 5 |
| 6 | GND | 6 |
| 7 | NC | 7 |
| 8 | GND | 8 |
| 9 | NC | 9 |
| 10 | NC | 10 |
| 11 | NC | 11 |
| 12 | GND | 12 |
| 13 | NC | 13 |
| 14 | NC | 14 |
| 15 | NC | 15 |
| 16 | NC | 16 |
| 17 | NC | 17 |
| 18 | NC | 18 |
| 19 | NC | 19 |
| 20 | NC | 20 |
| 21 | NC | 21 |
| 22 | GND | 22 |
| 23 | NC | 23 |
| 24 | GND | 24 |
| 25 | NC | 25 |
| 26 | GND | 26 |
| 27 | OPER/TEST* | 27 |
| 28 | PA7 | 28 |
| 29 | SLOW/FAST* | 29 |
| 30 | PA6 | 30 |
| 31 | GND | 31 |
| 32 | PA5 | 32 |
| 33 | GND | 33 |
| 34 | PA4 | 34 |
| 35 | PAR/LCD* | 35 |
| 36 | PA3 | 36 |
| 37 | GND | 37 |
| 38 | PA2 | 38 |
| 39 | GND | 39 |
| 40 | PA1 | 40 |
| 41 | MINX RESET* | 41 |
| 42 | PA0 | 42 |
| 43 | PULSE | 43 |
| 44 | OBF* | 44 |
| 45 | INT DET | 45 |
| 46 | ACK* | 46 |
| 47 | CALIB OK | 47 |
| 48 | IBF | 48 |
| 49 | SPARE | 49 |
| 50 | STB* | 50 |
| 51 | LQS | 51 |
| 52 | NC | 52 |
| 53 | NO PRB | 53 |
| 54 | RXD* | 54 |
| 55 | PRB OFF | 55 |
| 56 | NC | 56 |
| 57 | LO SAT | 57 |
| 58 | +5 0 ANALOG | 58 |
| 59 | 5 0 RTN | 59 |
| 60 | -5 0 ANALOG | 60 |
| 61 | +5V | 61 |
| 62 | +5V | 62 |
| 63 | GND | 63 |
| 64 | GND | 64 |

W2P1 W2P2

# Parts List PN 412658-001H

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 1 | | Cover, Module | 400895-001 | 1 |
| 2 | | Frame | 400982-001 | 1 |
| 3 | A1 | Power Supply PCB | 401309-002 | 1 |
| 4 | A3 | Non-Isolated Input PCB | 401315-002 | 1 |
| 5 | | Tubing, Silastic | 401582-001 | AR |
| 6 | | Shield, Top | 401679-001 | 1 |
| 7 | | Shield, Bottom | 401679-002 | 1 |
| 8 | | Latch | 401682-001 | 2 |
| 9 | | Button, Latch | 402106-001 | 2 |
| 10 | | Screw, Shoulder | 402214-001 | 4 |
| 11 | | Spring, Compression | 402315-001 | 2 |
| 12 | | Plate, Chassis Ground, Bottom/Front | 402317-001 | 1 |
| 13 | | Pin, Latch | 402806-001 | 2 |
| 14 | A7 | Power Indicator PCB | 403170-011 | 1 |
| 15 | A5 | Fan PCB Assembly | 403549-002 | 1 |
| 16 | | Spring, Chassis Ground, Rear | 403741-001 | AR |
| 17 | | Screw, BDGH, Phillips, 4-40 x 7/8 | 404069-001 | 2 |
| 18 | | Insulator, Bottom Shield | 404188-001 | 2 |
| 19 | | Carton, Shipping | 404211-003 | 1 |
| 20 | | Foam, Insert | 404211-004 | |
| 21 | | Bracket, NBP Mounting | 404296-001 | 1 |
| 22 | | Label, Blank | 404525-006 | 1 |
| 23 | | Trim, Rubber, Front Bezel | 404620-001 | 1 |
| 24 | | Mounting Strap, Trim | 404621-001 | 1 |
| 25 | | Check Valve, 0.125 ID | 404675-001 | 1 |
| 26 | | Filter, 43 Micron | 404679-001 | 1 |
| 27 | | Plate, Chassis Ground, Rear | 404680-002 | 1 |
| 28 | | Grommet, 1/4 Dia, 1/8 High, 1/16 Panel Thickness | 404749-001 | 5 |
| 29 | | Spring, Flat, SST | 405041-001 | 2 |
| 30 | | Spring, Latch | 406019-001 | 2 |
| 31 | | Pin, Latch | 406037-001 | 2 |
| 32 | | Bracket, Power Supply PCB | 406254-001 | 1 |
| 33 | W2 | Connector, Header, Dual, 64-Pin | 407452-002 | 1 |
| 34 | A10 | Pump Assembly, NBP, w/Harness | 408169-002 | 1 |
| 35 | A9 | 800 Acquisition Module, 10-Lead | 417123-001 | 1 |
| 36 | | Front Bezel, Tram | 402659-001 | 1 |
| 37 | A6 | NBP Valve Assembly | 416153-001 | 1 |
| 38 | | Label, Pulse Oximetry, Nellcor | 413831-002 | 1 |
| 39 | A4 | Pulse Oximetry Assembly (Including Pulse Oximetry PCB, PN 800674-00X) | 414409-001 | 1 |
| 40 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 4502-406 | 2 |

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 41 | | Screw, BDGH, Phillips, 4-40 x 1-1/4 | 4502-440 | 4 |
| 42 | | Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16 | 4505-406 | 6 |
| 43 | | Screw, FLH, Phillips, SST, 4-40 x 3/8 | 4505-412 | 2 |
| 44 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 45074-406 | 16 |
| 45 | | Screw, BDGH, Phillips, 4-40 x 3/8 | 45074-412 | 2 |
| 46 | | Screw, BDGH, Phillips, 4-40 x 5/8 | 45074-420 | 2 |
| 47 | | Screw, BDGH, Phillips, 4-40 x 3/4 | 45074-424 | 4 |
| 48 | | Nut, Hex, 4-40 | 4521-304 | 2 |
| 49 | | Tie Wrap | 4535-002 | 1 |
| 50 | | Adhesive, Diecut, Front Right | 415098-003 | 1 |
| 51 | A2 | Module Processor PCB | 800210-005 | 1 |
| 52 | A8 | NPB PCB | 800316-002 | 1 |
| 53 | W1 | Harness, Pulse Oximetry PCB-to-Connector | 800892-001 | 1 |
| 54 | | Label, UL Listed | 40230-003 | 1 |
| 55 | | Label, 60 Hertz | 411091-018 | 1 |
| 55 | | Label, 50 Hertz | 411091-019 | 1 |
| 56 | | Label, Top, English (Determined by Destination) | 411091-009 | 1 |
| 56 | | Label, Top, German (Determined by Destination) | 411091-010 | 1 |
| 56 | | Label, Top, French (Determined by Destination) | 411091-011 | 1 |
| 56 | | Label, Top, Swedish (Determined by Destination) | 411091-012 | 1 |
| 56 | | Label, Top, Spanish (Determined by Destination) | 411091-013 | 1 |
| 56 | | Label, Top, Italian (Determined by Destination) | 411091-014 | 1 |
| 56 | | Label, Top, Dutch (Determined by Destination) | 411091-015 | 1 |
| 57 | | Label, Front, 850SL, English (Determined by Destination) | 413842-001 | 1 |
| 57 | | Label, Front, 850SL, German (Determined by Destination) | 413842-002 | 1 |
| 57 | | Label, Front, 850SL, French (Determined by Destination) | 413842-003 | 1 |
| 57 | | Label, Front, 850SL, Swedish (Determined by Destination) | 413842-004 | 1 |
| 57 | | Label, Front, 850SL, Spanish (Determined by Destination) | 413842-005 | 1 |
| 57 | | Label, Front, 850SL, Italian (Determined by Destination) | 413842-006 | 1 |
| 57 | | Label, Front, 850SL, Dutch (Determined by Destination) | 413842-007 | 1 |
| 58 | | Label, Cover, English (Determined by Destination) | 414052-001 | 1 |
| 58 | | Label, Cover, German (Determined by Destination) | 414052-002 | 1 |
| 58 | | Label, Cover, French (Determined by Destination) | 414052-003 | 1 |
| 58 | | Label, Cover, Swedish (Determined by Destination) | 414052-004 | 1 |
| 58 | | Label, Cover, Spanish (Determined by Destination) | 414052-005 | 1 |
| 58 | | Label, Cover, Italian (Determined by Destination) | 414052-006 | 1 |
| 58 | | Label, Cover, International (Determined by Destination) | 414052-007 | 1 |

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 59 | | Screw, PHD, 4-40 x 0.188, Modified (Determined by Destination) | 409009-001 | 1 |
| 59 | | Screw, PHD, 4-40 x 0.188 (Determined by Destination) | 45074-406 | 1 |
| 60 | | Adhesive, Diecut, Front Left | 415098-002 | 1 |
| 61 | | Tram 100 - 850 A and SL Module Service Manual | 404422-065 | 1 |
| 62 | | Label, CE Mark | 408230-008 | 1 |
| 63 | | PC Post, 2 x 7 | 412062-004 | 1 |
| 64 | | PC Post, 2 x 11 | 412062-005 | 1 |
| 65 | | Spring, Chassis Ground, Small | 414610-001 | AR |

# Assembly Revisions PN 412658

The baseline revision for this assembly is pn 412658-001H. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

## PN 412658-001A

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 35 | A9 | DAS 800SL Module, 10-Lead | 411025-001 | 417123-001 | 1 |
| 37 | A6 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 50 | | Adhesive, Loctite Prism 411 | 4851-082 | 415098-001 | AR |
| 51 | | Module Processor PCB | 800210-002 | 800210-005 | 1 |
| 52 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |
| 59 | | Spring, Chassis Ground, Small | Not Used | 414610-001 | AR |
| 60 | | Adhesive, Diecut Front Left | Not Used | 415098-002 | 1 |
| 62 | | Label, CE Mark | Not Used | 408230-008 | 1 |
| 63 | | PC Post, 2 x 7 | Not Used | 412062-004 | 1 |
| 64 | | PC Post, 2 x 11 | Not Used | 412062-005 | 1 |

## PN 412658-001B

This revision was a documentation change that does not affect this manual.
Refer to pn 412658-001A for changes to the parts list.

## PN 412658-001C

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 35 | A9 | DAS 800SL Module, 10-Lead | 411025-001 | 417123-001 | 1 |
| 37 | A6 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 51 | | Module Processor PCB | 800210-002 | 800210-005 | 1 |
| 52 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |
| 62 | | Label, CE Mark | Not Used | 408230-008 | 1 |
| 63 | | PC Post, 2 x 7 | Not Used | 412062-004 | 1 |
| 64 | | PC Post, 2 x 11 | Not Used | 412062-005 | 1 |

## PN 412658-001D

This revision was a documentation change that does not affect this manual.
Refer to pn 412658-001C for changes to the parts list.

## PN 412658-001E

This revision was a documentation change that does not affect this manual.
Refer to pn 412658-001C for changes to the parts list.

## PN 412658-001F

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 35 | A9 | DAS 800SL Module, 10-Lead | 411025-001 | 417123-001 | 1 |
| 37 | A6 | NBP Valve Assembly | 413021-001 | 416153-001 | 1 |
| 52 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |

## PN 412658-001G

| Item | Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|---|
| 35 | A9 | DAS 800SL Module, 10-Lead | 411025-001 | 417123-001 | 1 |
| 52 | A8 | NBP PCB | 800316-001 | 800316-002 | 1 |

# 17

# 100/200 ACQUISITION MODULE PN 408134/411166/417120

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  Assembly Configurations .......... 17-2

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**Schematic Diagram PN 408134-001A/002A** .......... **17-4**

**Parts List PN 408134-001A/002A** .......... **17-5**

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**Parts List PN 417120-001B** .......... **17-11**

# General

## Safety

Observe the following warning:

**WARNING**
The DAS module contains the isolation barrier between the patient and the rest of the module. If the data acquisition module is removed, repaired, or replaced for any reason, the module must undergo the current leakage and hi-pot tests listed in Chapter 5: "Preventive Maintenance" before being used on a patient. These tests verify the integrity of the isolation barrier, and are necessary to ensure continued safe operation. Failure to perform the tests may cause undue equipment failure and possible health hazards.

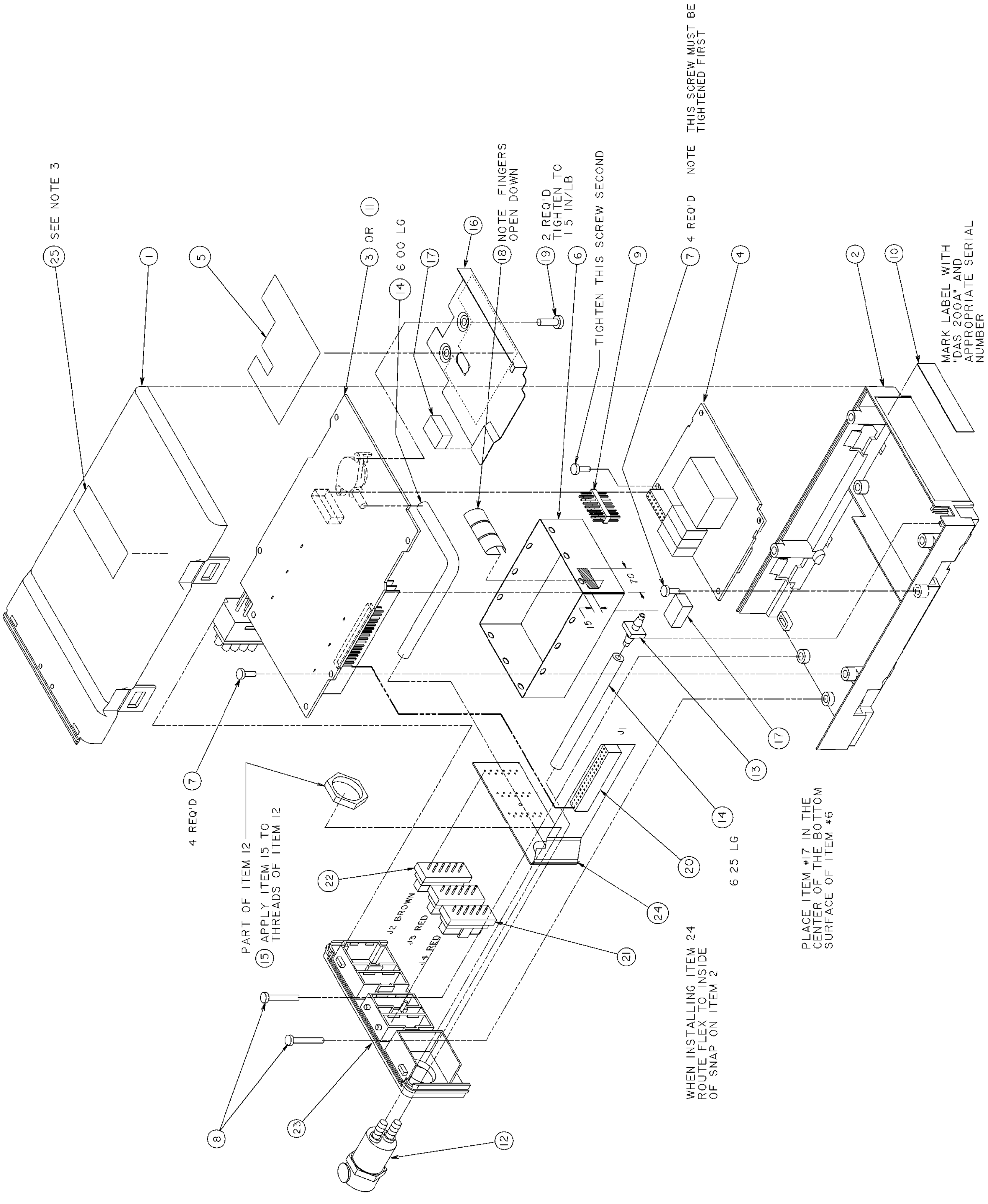
## Assembly Configurations

There are four configurations of the DAS module described in this chapter. The difference between the assemblies is in the number of ECG leadwires monitored and the acquisition processor PCB used in the DAS module itself. Use the table below to determine which parts lists to use in this manual for your Tram module.

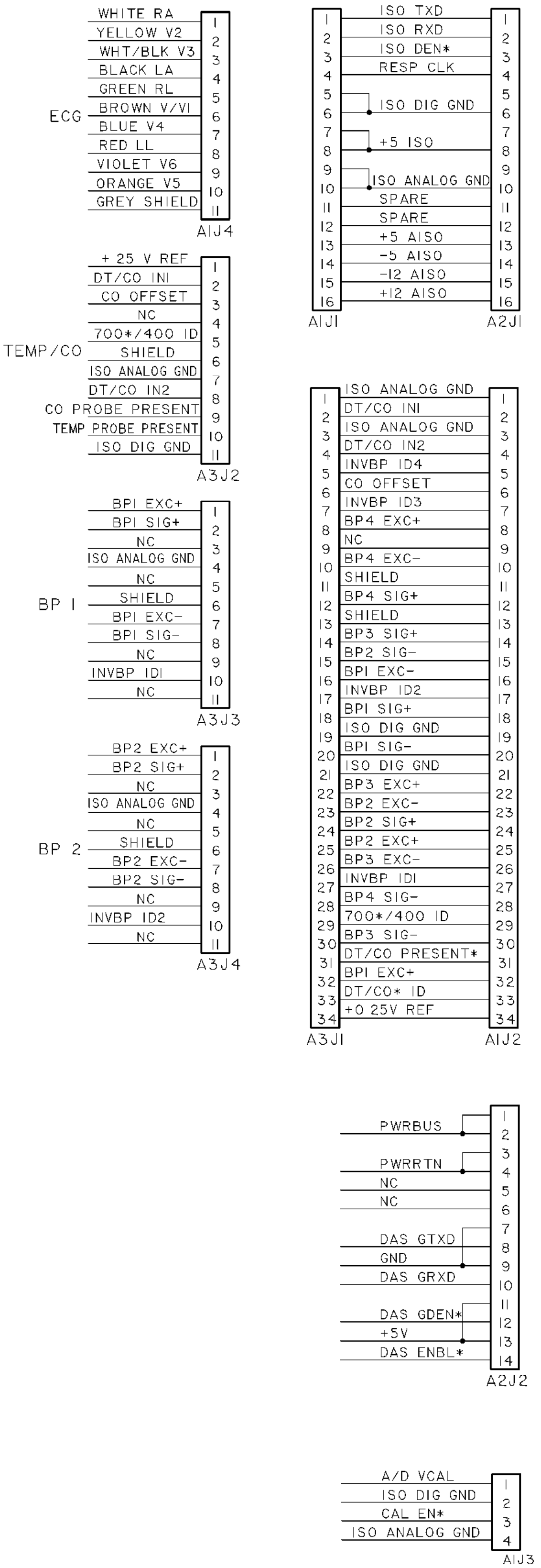
**Table 17-1. DAS Module Configurations**

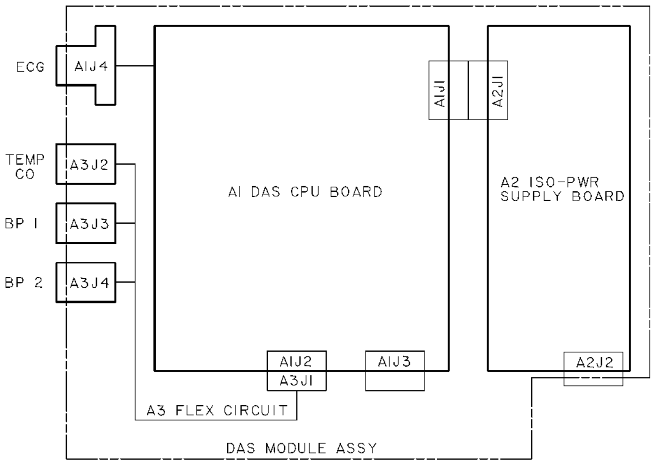
| Module Type | Leadwire Configuration | Acquisition Module | Acquisition Processor PCB |
|---|---|---|---|
| Tram 100A | 5-Leadwire | 408134-001 | 800330-005 |
| Tram 200A | 5-Leadwire | 408134-002 | 800330-006 |
| Tram 200SL | 10-Leadwire | 411166-001 | 800330-006 |
| Tram 200SL | 10-Leadwire | 417120-001 (Replaced 411166-001) | 801040-001 |
| Tram 250SL | 10-Leadwire | 411166-001 | 800330-006 |
| Tram 250SL | 10-Leadwire | 417120-001 (Replaced 411166-001) | 801040-001 |

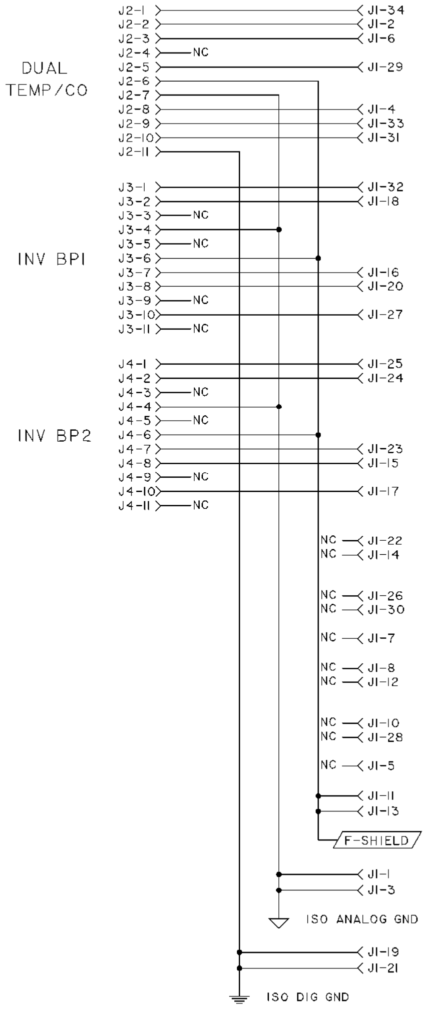
# Exploded View PN 418134-001A/002A


25 SEE NOTE 3
1
5
3 OR 11
14 6.00 LG
17
16
18 NOTE FINGERS OPEN DOWN
19 2 REQ'D TIGHTEN TO 1.5 IN/LB
6
TIGHTEN THIS SCREW SECOND
9
7 4 REQ'D NOTE THIS SCREW MUST BE TIGHTENED FIRST
4
2
10
MARK LABEL WITH "DAS 200A" AND APPROPRIATE SERIAL NUMBER
.70
.15
J1
17
13
14
6.25 LG
20
24
21
7 4 REQ'D
PART OF ITEM 12
15 APPLY ITEM 15 TO THREADS OF ITEM 12
22
J2 BROWN
J3 RED
J4 RED
PLACE ITEM #17 IN THE CENTER OF THE BOTTOM SURFACE OF ITEM #6
WHEN INSTALLING ITEM 24 ROUTE FLEX TO INSIDE OF SNAP ON ITEM 2
8
23
12

# Schematic Diagram PN 408134-001A/002A


ECG
WHITE RA 1
YELLOW V2 2
WHT/BLK V3 3
BLACK LA 4
GREEN RL 5
BROWN V/V1 6
BLUE V4 7
RED LL 8
VIOLET V6 9
ORANGE V5 10
GREY SHIELD 11
A1J4
TEMP/CO
+ 25 V REF 1
DT/CO IN1 2
CO OFFSET 3
NC 4
700*/400 ID 5
SHIELD 6
ISO ANALOG GND 7
DT/CO IN2 8
CO PROBE PRESENT 9
TEMP PROBE PRESENT 10
ISO DIG GND 11
A3J2
BP 1
BP1 EXC+ 1
BP1 SIG+ 2
NC 3
ISO ANALOG GND 4
NC 5
SHIELD 6
BP1 EXC- 7
BP1 SIG- 8
NC 9
INVBP ID1 10
NC 11
A3J3
BP 2
BP2 EXC+ 1
BP2 SIG+ 2
NC 3
ISO ANALOG GND 4
NC 5
SHIELD 6
BP2 EXC- 7
BP2 SIG- 8
NC 9
INVBP ID2 10
NC 11
A3J4
1 ISO TXD 1
2 ISO RXD 2
3 ISO DEN* 3
4 RESP CLK 4
5 6 ISO DIG GND 5 6
7 8 +5 ISO 7 8
9 10 ISO ANALOG GND 9 10
11 SPARE 11
12 SPARE 12
13 +5 AISO 13
14 -5 AISO 14
15 -12 AISO 15
16 +12 AISO 16
A1J1 A2J1
1 ISO ANALOG GND 1
2 DT/CO IN1 2
3 ISO ANALOG GND 3
4 DT/CO IN2 4
5 INVBP ID4 5
6 CO OFFSET 6
7 INVBP ID3 7
8 BP4 EXC+ 8
9 NC 9
10 BP4 EXC- 10
11 SHIELD 11
12 BP4 SIG+ 12
13 SHIELD 13
14 BP3 SIG+ 14
15 BP2 SIG- 15
16 BP1 EXC- 16
17 INVBP ID2 17
18 BP1 SIG+ 18
19 ISO DIG GND 19
20 BP1 SIG- 20
21 ISO DIG GND 21
22 BP3 EXC+ 22
23 BP2 EXC- 23
24 BP2 SIG+ 24
25 BP2 EXC+ 25
26 BP3 EXC- 26
27 INVBP ID1 27
28 BP4 SIG- 28
29 700*/400 ID 29
30 BP3 SIG- 30
31 DT/CO PRESENT* 31
32 BP1 EXC+ 32
33 DT/CO* ID 33
34 +0 25V REF 34
A3J1 A1J2
PWRBUS 1 2
PWRRTN 3 4
NC 5
NC 6
DAS GTXD 7 8
GND 9
DAS GRXD 10
DAS GDEN* 11 12
+5V 13
DAS ENBL* 14
A2J2
A/D VCAL 1
ISO DIG GND 2
CAL EN* 3
ISO ANALOG GND 4
A1J3


ECG
A1J4
TEMP CO
A3J2
BP 1
A3J3
BP 2
A3J4
A1 DAS CPU BOARD
A1J1
A2J1
A2 ISO-PWR SUPPLY BOARD
A1J2
A3J1
A1J3
A2J2
A3 FLEX CIRCUIT
DAS MODULE ASSY

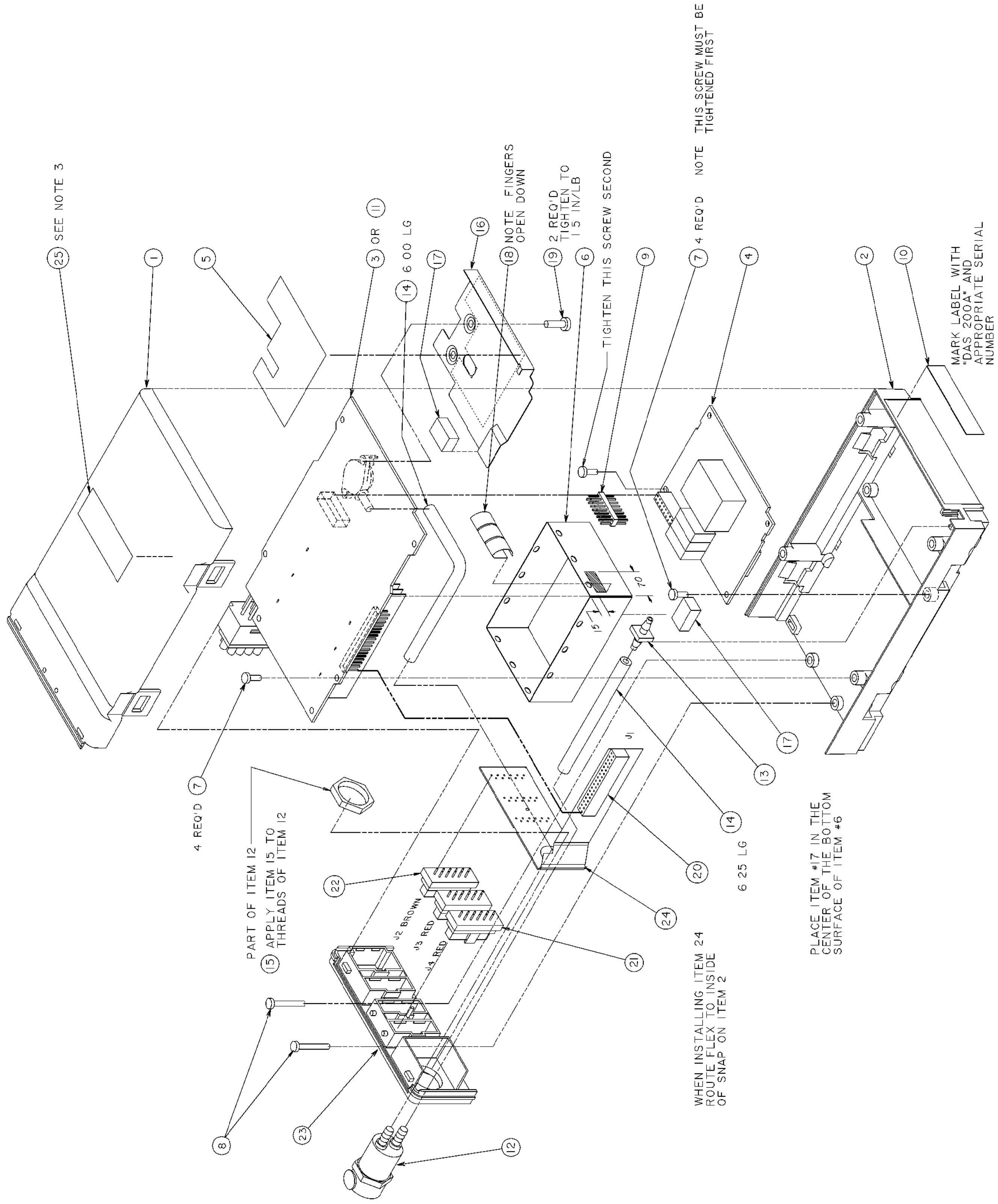

DUAL TEMP/CO
J2-1 J1-34
J2-2 J1-2
J2-3 J1-6
J2-4 NC
J2-5 J1-29
J2-6
J2-7
J2-8 J1-4
J2-9 J1-33
J2-10 J1-31
J2-11
INV BP1
J3-1 J1-32
J3-2 J1-18
J3-3 NC
J3-4
J3-5 NC
J3-6
J3-7 J1-16
J3-8 J1-20
J3-9 NC
J3-10 J1-27
J3-11 NC
INV BP2
J4-1 J1-25
J4-2 J1-24
J4-3 NC
J4-4
J4-5 NC
J4-6
J4-7 J1-23
J4-8 J1-15
J4-9 NC
J4-10 J1-17
J4-11 NC
NC J1-22
NC J1-14
NC J1-26
NC J1-30
NC J1-7
NC J1-8
NC J1-12
NC J1-10
NC J1-28
NC J1-5
J1-11
J1-13
F-SHIELD
J1-1
J1-3
ISO ANALOG GND
J1-19
J1-21
ISO DIG GND

*FLEX CIRCUIT SCHEMATIC*

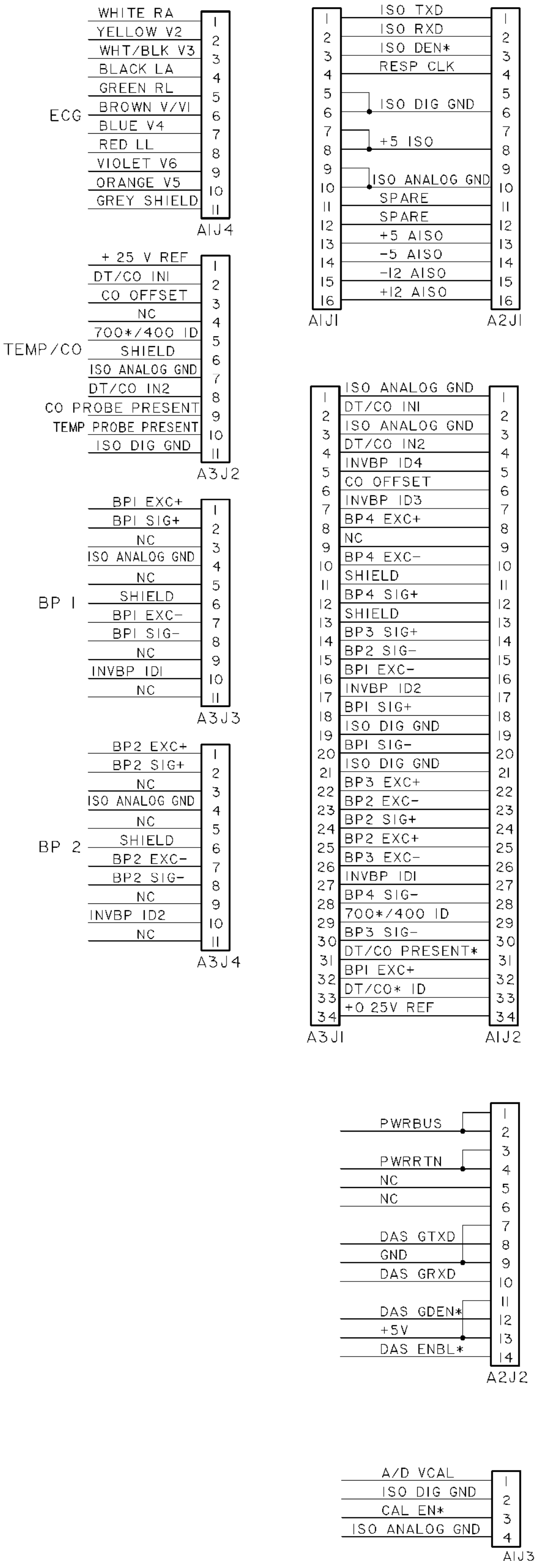
# Parts List PN 408134-001A/002A

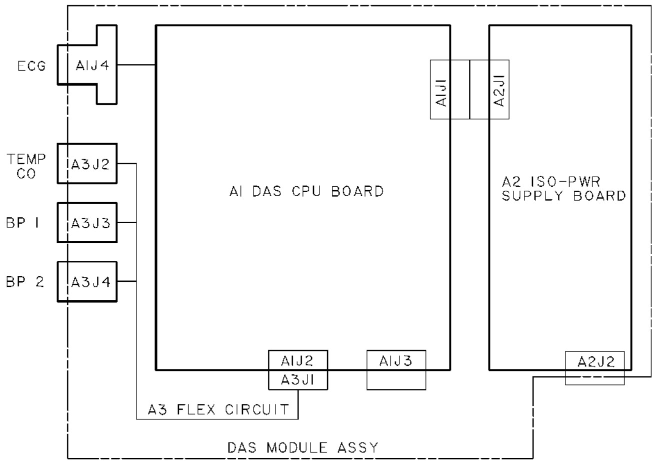
| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 1 | | Cover, Top | 401311-001 | 1 |
| 2 | | Cover, Lower | 401681-001 | 1 |
| 3 | A1 | Acquisition Processor PCB, 5-Lead, 2-BP, W/NBP (For PN 408134-001 Only) | 800330-005 | 1 |
| 4 | A2 | Isolated Power Supply PCB | 402329-002 | 1 |
| 5 | | Insulator | 408417-001 | 1 |
| 6 | | Shield, Hybrids | 403283-002 | 1 |
| 7 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 45074-406 | 8 |
| 8 | | Screw, 4-40 x 7/8 | 404069-001 | 2 |
| 9 | A1J1, A2J1 | Header, Vertical, 16-Pin | 1778-916 | 1 |
| 10 | | Label, Model/Serial Number | 404525-006 | 1 |
| 11 | A1 | Acquisition Processor PCB, 10-Lead, 2-BP, W/NBP (For PN 408134-002 Only) | 800330-006 | 1 |
| 12 | | Connector, Pneumatic, NBP | 401184-001 | 1 |
| 13 | | Connector, Pneumatic | 404445-001 | 1 |
| 14 | | Tubing, Silastic | 401582-001 | AR |
| 15 | | Adhesive, Permabond 910FS | 4851-074 | AR |
| 16 | | Shield, Acquisition Processor PCB, Lower | 405517-001 | 1 |
| 17 | | Tape, Foam | 4819-102 | AR |
| 18 | | Spring, Chassis Ground, Rear | 403741-001 | AR |
| 19 | | Screw, BDGH, Phillips, 6-32 x 7/16 | 45074-918 | 2 |
| 20 | A3J1 | Connector, 34-Pin, Horizontal | 17020-034 | 1 |
| 21 | A3J3, A3J4 | Connector, BP (Red) | 401762-004 | 2 |
| 22 | A3J2 | Connector, TEMP/CO (Brown) | 401762-021 | 1 |
| 23 | | Isolated Connector Panel, Tram 100/200 | 402159-002 | 1 |
| 24 | A3 | Flex Circuit, BP/Temp | 404109-002 | 1 |
| 25 | | Label (Marked with "WARNING, TRAM TYPE MUST BE SET WHEN DAS MODULE IS EXCHANGED") | 404525-001 | 1 |

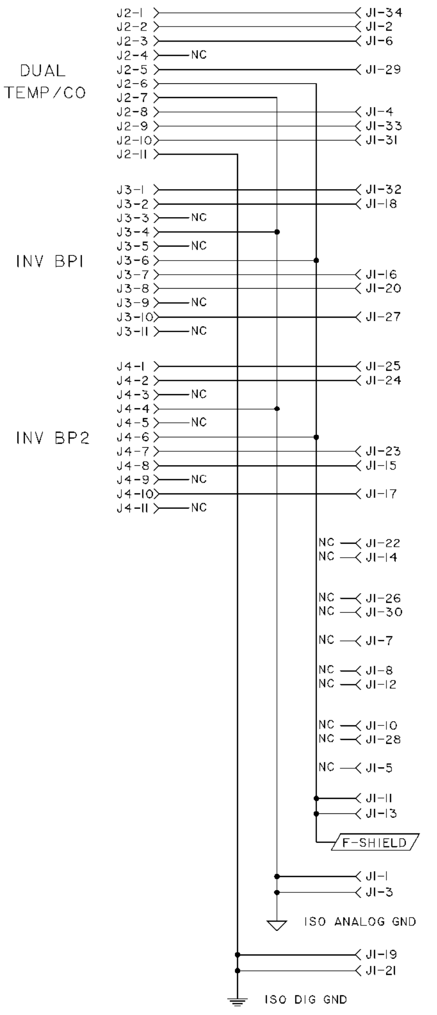
# Exploded View PN 411166-001B


25 SEE NOTE 3
1
5
3 OR 11
14 6.00 LG
17
16
18 NOTE FINGERS OPEN DOWN
19 2 REQ'D TIGHTEN TO 15 IN/LB
6
TIGHTEN THIS SCREW SECOND
9
7 4 REQ'D
NOTE THIS SCREW MUST BE TIGHTENED FIRST
4
2
10
MARK LABEL WITH "DAS 200A" AND APPROPRIATE SERIAL NUMBER
.70
.15
J1
17
13
14 6.25 LG
20
24
21
22
J2 BROWN
J3 RED
J4 RED
4 REQ'D 7
PART OF ITEM 12
15 APPLY ITEM 15 TO THREADS OF ITEM 12
8
23
12
WHEN INSTALLING ITEM 24 ROUTE FLEX TO INSIDE OF SNAP ON ITEM 2
PLACE ITEM #17 IN THE CENTER OF THE BOTTOM SURFACE OF ITEM #6

# Schematic Diagram PN 411166-001B


ECG
WHITE RA 1
YELLOW V2 2
WHT/BLK V3 3
BLACK LA 4
GREEN RL 5
BROWN V/V1 6
BLUE V4 7
RED LL 8
VIOLET V6 9
ORANGE V5 10
GREY SHIELD 11
A1J4
TEMP/CO
+ 25 V REF 1
DT/CO IN1 2
CO OFFSET 3
NC 4
700*/400 ID 5
SHIELD 6
ISO ANALOG GND 7
DT/CO IN2 8
CO PROBE PRESENT 9
TEMP PROBE PRESENT 10
ISO DIG GND 11
A3J2
BP 1
BP1 EXC+ 1
BP1 SIG+ 2
NC 3
ISO ANALOG GND 4
NC 5
SHIELD 6
BP1 EXC- 7
BP1 SIG- 8
NC 9
INVBP ID1 10
NC 11
A3J3
BP 2
BP2 EXC+ 1
BP2 SIG+ 2
NC 3
ISO ANALOG GND 4
NC 5
SHIELD 6
BP2 EXC- 7
BP2 SIG- 8
NC 9
INVBP ID2 10
NC 11
A3J4
1 ISO TXD 1
2 ISO RXD 2
3 ISO DEN* 3
4 RESP CLK 4
5 6 ISO DIG GND 5 6
7 8 +5 ISO 7 8
9 10 ISO ANALOG GND 9 10
11 SPARE 11
12 SPARE 12
13 +5 AISO 13
14 -5 AISO 14
15 -12 AISO 15
16 +12 AISO 16
A1J1 A2J1
1 ISO ANALOG GND 1
2 DT/CO IN1 2
3 ISO ANALOG GND 3
4 DT/CO IN2 4
5 INVBP ID4 5
6 CO OFFSET 6
7 INVBP ID3 7
8 BP4 EXC+ 8
9 NC 9
10 BP4 EXC- 10
11 SHIELD 11
12 BP4 SIG+ 12
13 SHIELD 13
14 BP3 SIG+ 14
15 BP2 SIG- 15
16 BP1 EXC- 16
17 INVBP ID2 17
18 BP1 SIG+ 18
19 ISO DIG GND 19
20 BP1 SIG- 20
21 ISO DIG GND 21
22 BP3 EXC+ 22
23 BP2 EXC- 23
24 BP2 SIG+ 24
25 BP2 EXC+ 25
26 BP3 EXC- 26
27 INVBP ID1 27
28 BP4 SIG- 28
29 700*/400 ID 29
30 BP3 SIG- 30
31 DT/CO PRESENT* 31
32 BP1 EXC+ 32
33 DT/CO* ID 33
34 +0 25V REF 34
A3J1 A1J2
PWRBUS 1 2
PWRRTN 3 4
NC 5
NC 6
DAS GTXD 7 8
GND 9
DAS GRXD 10
DAS GDEN* 11 12
+5V 13
DAS ENBL* 14
A2J2
A/D VCAL 1
ISO DIG GND 2
CAL EN* 3
ISO ANALOG GND 4
A1J3


ECG
A1J4
TEMP CO
A3J2
BP 1
A3J3
BP 2
A3J4
A1 DAS CPU BOARD
A1J1
A2J1
A2 ISO-PWR SUPPLY BOARD
A1J2
A3J1
A1J3
A2J2
A3 FLEX CIRCUIT
DAS MODULE ASSY

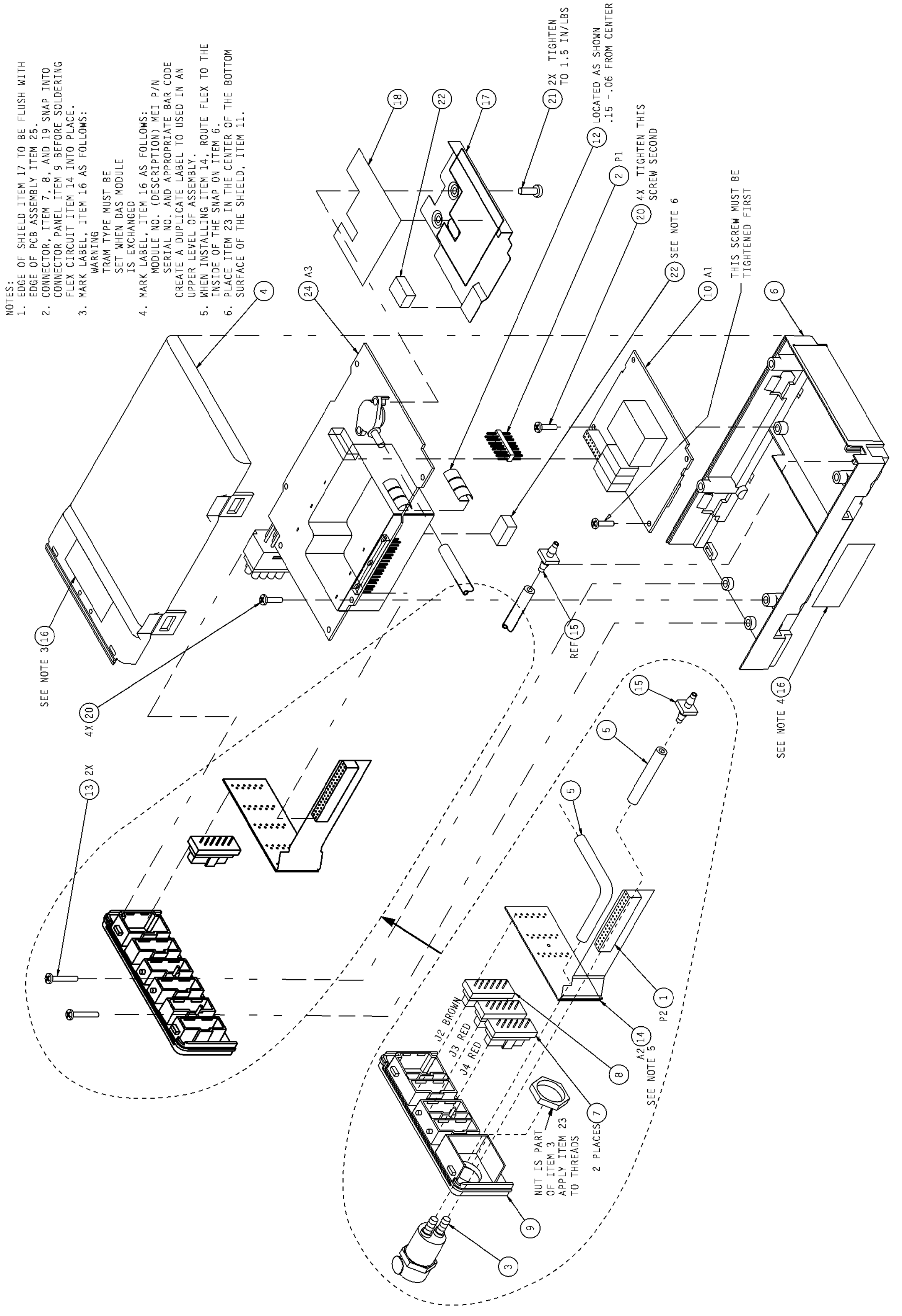

DUAL TEMP/CO
J2-1 J1-34
J2-2 J1-2
J2-3 J1-6
J2-4 NC
J2-5 J1-29
J2-6
J2-7
J2-8 J1-4
J2-9 J1-33
J2-10 J1-31
J2-11
INV BP1
J3-1 J1-32
J3-2 J1-18
J3-3 NC
J3-4
J3-5 NC
J3-6
J3-7 J1-16
J3-8 J1-20
J3-9 NC
J3-10 J1-27
J3-11 NC
INV BP2
J4-1 J1-25
J4-2 J1-24
J4-3 NC
J4-4
J4-5 NC
J4-6
J4-7 J1-23
J4-8 J1-15
J4-9 NC
J4-10 J1-17
J4-11 NC
NC J1-22
NC J1-14
NC J1-26
NC J1-30
NC J1-7
NC J1-8
NC J1-12
NC J1-10
NC J1-28
NC J1-5
J1-11
J1-13
F-SHIELD
J1-1
J1-3
ISO ANALOG GND
J1-19
J1-21
ISO DIG GND

*FLEX CIRCUIT SCHEMATIC*

# Parts List PN 411166-001B

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 1 | | Cover, Top | 401311-001 | 0 |
| 2 | | Cover, Lower | 401681-001 | 0 |
| 3 | A1 | Acquisition Processor PCB, 10-Lead, 2-BP, W/NBP | 800330-006 | 1 |
| 4 | A2 | Isolated Power Supply PCB | 402329-002 | 1 |
| 5 | | Insulator | 408417-001 | 1 |
| 7 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 45074-406 | 8 |
| 8 | | Screw, 4-40 x 7/8 | 404069-001 | 2 |
| 9 | | Header, Vertical, 16-Pin | 1778-916 | 1 |
| 10 | | Label (Marked with “WARNING, TRAM TYPE MUST BE SET WHEN DAS MODULE IS EXCHANGED”) | 404525-001 | 2 |
| 12 | | Connector, Pneumatic, NBP | 401184-001 | 1 |
| 13 | | Connector, Pneumatic | 404445-001 | 1 |
| 14 | | Tubing, Silastic | 401582-001 | AR |
| 15 | | Adhesive, Permabond 910FS | 4851-074 | AR |
| 16 | | Shield, Acquisition Processor PCB, Lower | 405517-001 | 1 |
| 17 | | Tape, Foam | 4819-102 | 2 |
| 18 | | Spring, Chassis Ground, Rear | 403741-001 | AR |
| 19 | | Screw, BDGH, Phillips, 6-32 x 1/2 | 45074-917 | 2 |
| 20 | | Connector, 34-Pin, Horizontal | 17020-034 | 1 |
| 21 | | Connector, BP (Red) | 401762-004 | 2 |
| 22 | | Connector, TEMP/CO (Brown) | 401762-021 | 1 |
| 23 | | Isolated Connector Panel, Tram 100/200 | 402159-002 | 1 |
| 24 | A3 | Flex Circuit, BP/Temp | 404109-002 | 1 |

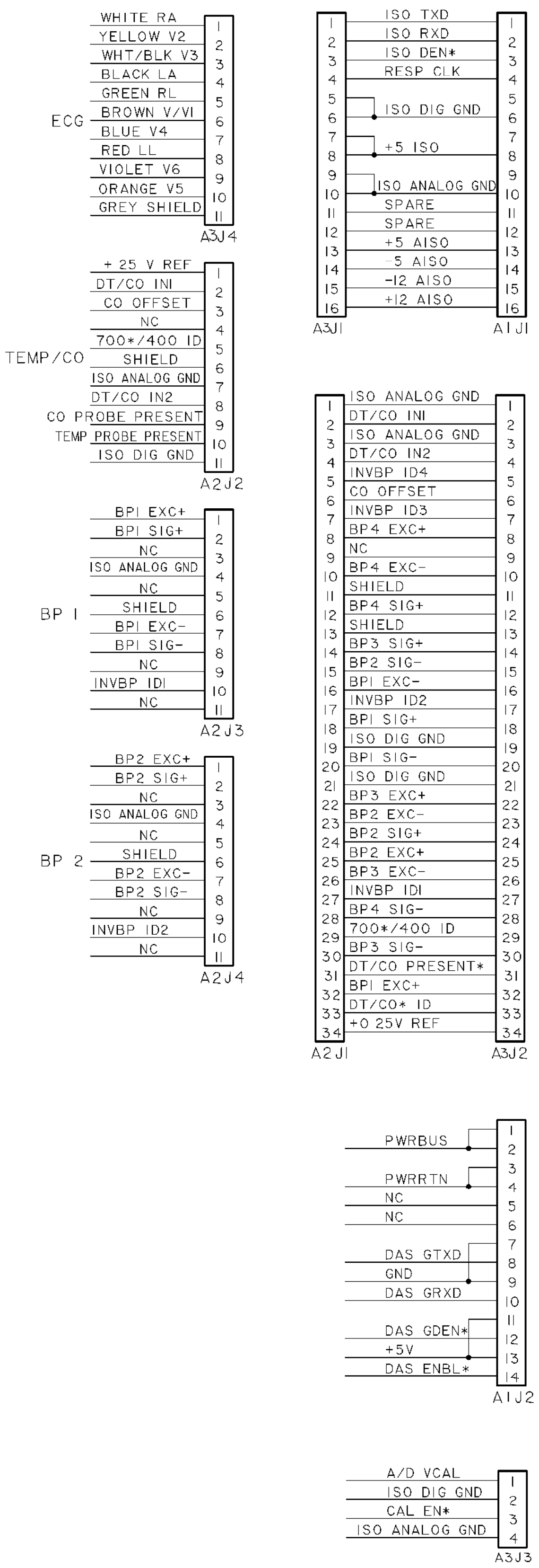
# Exploded View PN 417120-001B

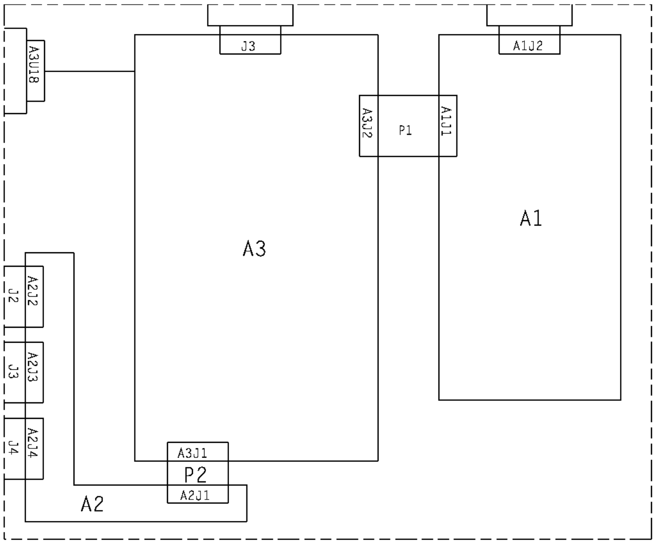


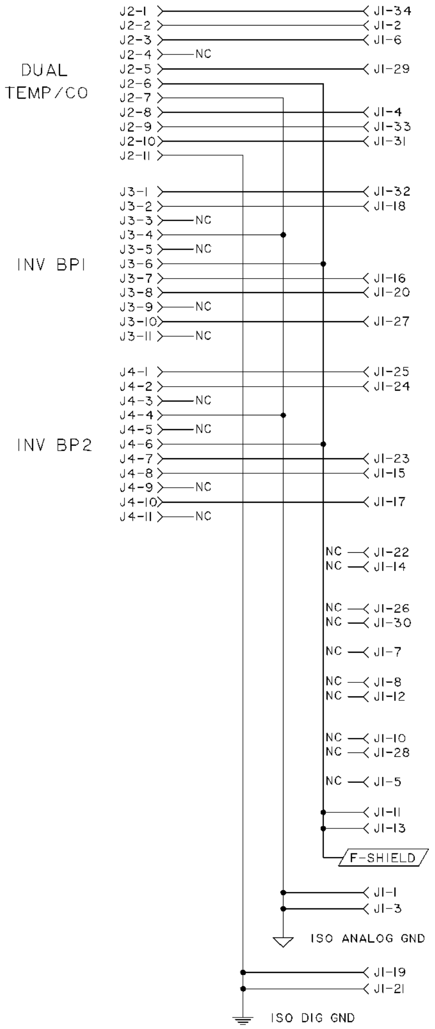
NOTES:
1. EDGE OF SHIELD ITEM 17 TO BE FLUSH WITH EDGE OF PCB ASSEMBLY ITEM 25.
2. CONNECTOR, ITEM 7, 8, AND 19 SNAP INTO CONNECTOR PANEL ITEM 9 BEFORE SOLDERING FLEX CIRCUIT ITEM 14 INTO PLACE.
3. MARK LABEL, ITEM 16 AS FOLLOWS:
   WARNING
   TRAM TYPE MUST BE
   SET WHEN DAS MODULE
   IS EXCHANGED
4. MARK LABEL, ITEM 16 AS FOLLOWS:
   MODULE NO. (DESCRIPTION) MEI P/N
   SERIAL NO. AND APPROPRIATE BAR CODE
   CREATE A DUPLICATE LABEL TO USED IN AN UPPER LEVEL OF ASSEMBLY.
5. WHEN INSTALLING ITEM 14, ROUTE FLEX TO THE INSIDE OF THE SNAP ON ITEM 6.
6. PLACE ITEM 23 IN THE CENTER OF THE BOTTOM SURFACE OF THE SHIELD, ITEM 11.

18
22
17
21 2X TIGHTEN TO 1.5 IN/LBS
12 LOCATED AS SHOWN .15 - .06 FROM CENTER
2 P1
20 4X TIGHTEN THIS SCREW SECOND
22 SEE NOTE 6
10 A1
THIS SCREW MUST BE TIGHTENED FIRST
6
4
24 A3
SEE NOTE 3 16
4X 20
REF 15
SEE NOTE 4 16
2X 13
15
5
5
P2 1
A2 14 SEE NOTE 5
8
7 2 PLACES
J2 BROWN
J3 RED
J4 RED
NUT IS PART OF ITEM 3 APPLY ITEM 23 TO THREADS
9
3

# Schematic Diagram PN 417120-001B


ECG
WHITE RA
YELLOW V2
WHT/BLK V3
BLACK LA
GREEN RL
BROWN V/VI
BLUE V4
RED LL
VIOLET V6
ORANGE V5
GREY SHIELD
A3J4
TEMP/CO
+ 25 V REF
DT/CO IN1
CO OFFSET
NC
700*/400 ID
SHIELD
ISO ANALOG GND
DT/CO IN2
CO PROBE PRESENT
TEMP PROBE PRESENT
ISO DIG GND
A2J2
BP 1
BP1 EXC+
BP1 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP1 EXC-
BP1 SIG-
NC
INVBP ID1
NC
A2J3
BP 2
BP2 EXC+
BP2 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP2 EXC-
BP2 SIG-
NC
INVBP ID2
NC
A2J4
ISO TXD
ISO RXD
ISO DEN*
RESP CLK
ISO DIG GND
+5 ISO
ISO ANALOG GND
SPARE
SPARE
+5 AISO
-5 AISO
-12 AISO
+12 AISO
A3J1
A1J1
ISO ANALOG GND
DT/CO IN1
ISO ANALOG GND
DT/CO IN2
INVBP ID4
CO OFFSET
INVBP ID3
BP4 EXC+
NC
BP4 EXC-
SHIELD
BP4 SIG+
SHIELD
BP3 SIG+
BP2 SIG-
BP1 EXC-
INVBP ID2
BP1 SIG+
ISO DIG GND
BP1 SIG-
ISO DIG GND
BP3 EXC+
BP2 EXC-
BP2 SIG+
BP2 EXC+
BP3 EXC-
INVBP ID1
BP4 SIG-
700*/400 ID
BP3 SIG-
DT/CO PRESENT*
BP1 EXC+
DT/CO* ID
+0 25V REF
A2J1
A3J2
PWRBUS
PWRRTN
NC
NC
DAS GTXD
GND
DAS GRXD
DAS GDEN*
+5V
DAS ENBL*
A1J2
A/D VCAL
ISO DIG GND
CAL EN*
ISO ANALOG GND
A3J3


A3U18
J3
A1J2
A3J2
P1
A1J1
A1
A3
A2J2
J2
A2J3
J3
A2J4
J4
A3J1
P2
A2J1
A2


DUAL TEMP/CO
INV BP1
INV BP2
J2-1
J2-2
J2-3
J2-4
J2-5
J2-6
J2-7
J2-8
J2-9
J2-10
J2-11
J3-1
J3-2
J3-3
J3-4
J3-5
J3-6
J3-7
J3-8
J3-9
J3-10
J3-11
J4-1
J4-2
J4-3
J4-4
J4-5
J4-6
J4-7
J4-8
J4-9
J4-10
J4-11
NC
J1-34
J1-2
J1-6
J1-29
J1-4
J1-33
J1-31
J1-32
J1-18
J1-16
J1-20
J1-27
J1-25
J1-24
J1-23
J1-15
J1-17
J1-22
J1-14
J1-26
J1-30
J1-7
J1-8
J1-12
J1-10
J1-28
J1-5
J1-11
J1-13
F-SHIELD
J1-1
J1-3
ISO ANALOG GND
J1-19
J1-21
ISO DIG GND

*FLEX CIRCUIT SCHEMATIC*

# Parts List PN 417120-001B

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 1 | P2 | Connector, 34-Pin, Horizontal | 17020-034 | 1 |
| 2 | P1 | Header, Vertical, 16-Pin | 1778-916 | 1 |
| 3 | | Connector, Pneumatic, NBP | 401184-001 | 1 |
| 4 | | Cover, Top | 401311-001 | 1 |
| 5 | | Tubing, Silastic | 401582-001 | AR |
| 6 | | Cover, Lower | 401681-001 | 1 |
| 7 | | Connector, BP (Red) | 401762-004 | 2 |
| 8 | | Connector, TEMP/CO (Brown) | 401762-021 | 1 |
| 9 | | Isolated Connector Panel, Tram 100/200 | 402159-002 | 1 |
| 10 | A1 | Isolated Power Supply PCB | 402329-002 | 1 |
| 12 | | Spring, Chassis Ground, Rear | 403741-001 | AR |
| 13 | | Screw, 4-40 x 7/8 | 404069-001 | 2 |
| 14 | A2 | Flex Circuit, BP/Temp | 404109-002 | 1 |
| 15 | | Connector, Pneumatic | 404445-001 | 1 |
| 16 | | Label (Marked with "WARNING, TRAM TYPE MUST BE SET WHEN DAS MODULE IS EXCHANGED") | 404525-001 | 2 |
| 17 | | Shield, Acquisition Processor PCB, Lower | 405517-001 | 1 |
| 18 | | Insulator | 408417-001 | 1 |
| 20 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 45074-406 | 8 |
| 21 | | Screw, BDGH, Phillips, 6-32 x 1/2 | 45074-917 | 2 |
| 22 | | Tape, Foam | 4819-102 | 2 |
| 23 | | Adhesive, Permabond 910FS | 4851-074 | AR |
| 24 | A3 | Acquisition Processor PCB, 10-Lead, 2-BP, W/NBP | 801040-001 | 1 |

*For your notes*

# 18 400 ACQUISITION MODULE PN 410495/411167/417121

**General** .......... **18-2**
  Safety .......... 18-2
  Assembly Configurations .......... 18-2

**Exploded View PN 410495-001D** .......... **18-3**

**Schematic Diagram PN 410495-001D** .......... **18-4**

**Module Parts List PN 410495-001D** .......... **18-5**

**Exploded View PN 411167-001C** .......... **18-6**

**Schematic Diagram PN 411167-001C** .......... **18-7**

**Parts List PN 411167-001C** .......... **18-8**

**Exploded View PN 417121-001B** .......... **18-9**

**Schematic Diagram PN 417121-001B** .......... **18-10**

**Parts List PN 417121-001B** .......... **18-11**

# General

## Safety

Observe the following warning:

**WARNING**
The data acquisition module contains the isolation barrier between the patient and the rest of the module. If the data acquisition module is removed, repaired, or replaced for any reason, the module must undergo the current leakage and hi-pot tests listed in Chapter 5: “Preventive Maintenance” before being used on a patient. These tests verify the integrity of the isolation barrier, and are necessary to ensure continued safe operation. Failure to perform the tests may cause undue equipment failure and possible health hazards.

## Assembly Configurations

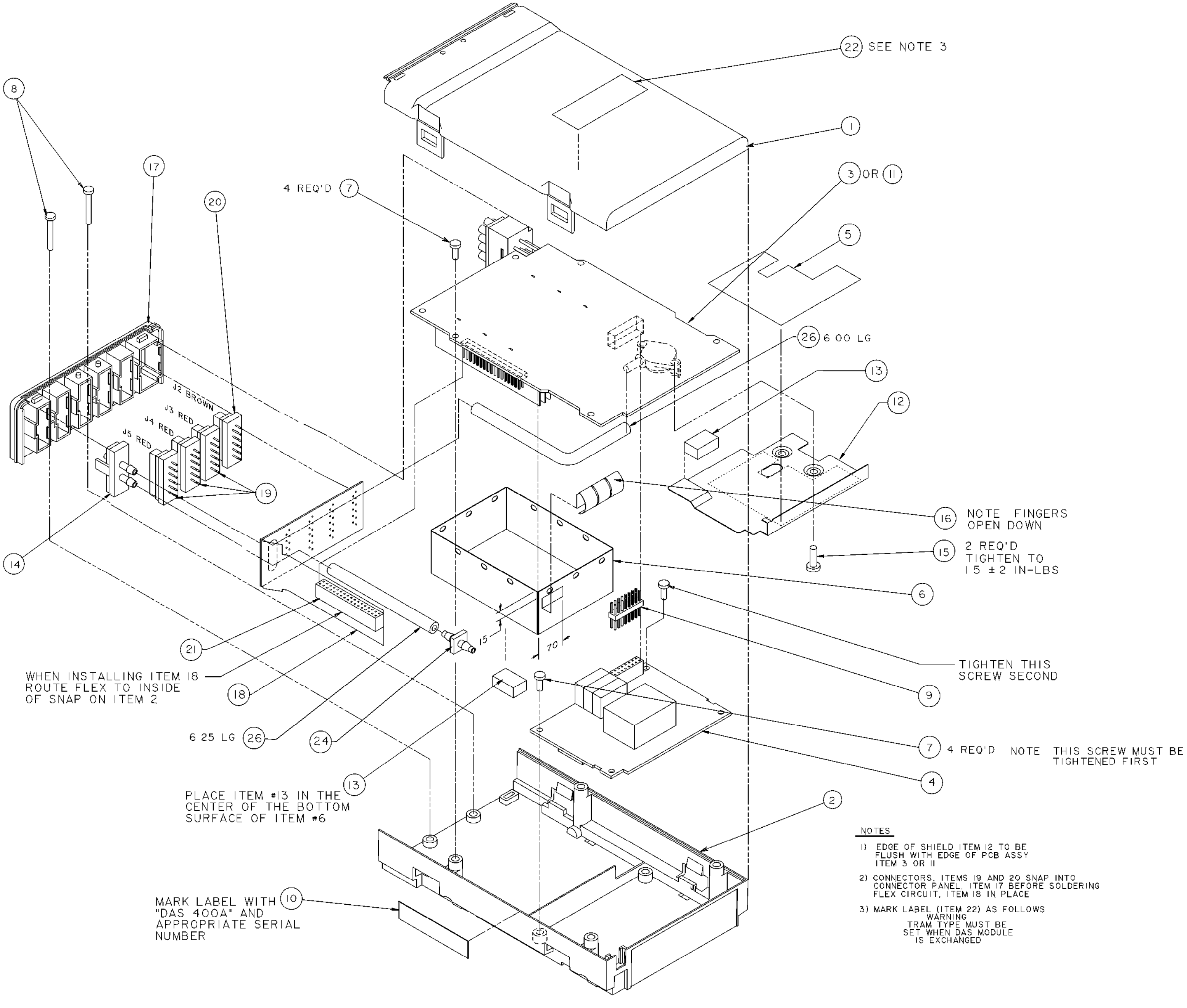
There are three configurations of the data acquisition module described in this chapter. The difference between the assemblies is in the number of ECG leadwires monitored and the acquisition processor PCB used in the DAS module itself. Use the table below to determine which parts lists to use in this manual for your Tram module.

**Table 18-1. DAS Module Configurations**

| Module Type | Leadwire Configuration | DAS Module | Acquisition Processor PCB |
|---|---|---|---|
| Tram 400A | 5-Leadwire | 410495-001 | 800330-009 |
| Tram 400SL | 10-Leadwire | 411167-001 | 800330-010 |
| Tram 400SL | 10-Leadwire | 417121-001 (Replaced 411167-001) | 801040-001 |
| Tram 450SL | 10-Leadwire | 411167-001 | 800330-010 |
| Tram 450SL | 10-Leadwire | 417121-001 (Replaced 411167-001) | 801040-001 |

# Exploded View

# PN 410495-001D


22 SEE NOTE 3
1
3 OR 11
5
26 6 00 LG
13
12
16 NOTE FINGERS OPEN DOWN
15 2 REQ'D TIGHTEN TO 15 ±2 IN-LBS
6
TIGHTEN THIS SCREW SECOND
9
7 4 REQ'D NOTE THIS SCREW MUST BE TIGHTENED FIRST
4
2
4 REQ'D 7
8
17
20
J2 BROWN
J3 RED
J4 RED
J5 RED
19
14
21
WHEN INSTALLING ITEM 18 ROUTE FLEX TO INSIDE OF SNAP ON ITEM 2
18
6 25 LG 26
24
15
70
PLACE ITEM #13 IN THE CENTER OF THE BOTTOM SURFACE OF ITEM #6
13
MARK LABEL WITH "DAS 400A" AND APPROPRIATE SERIAL NUMBER
10

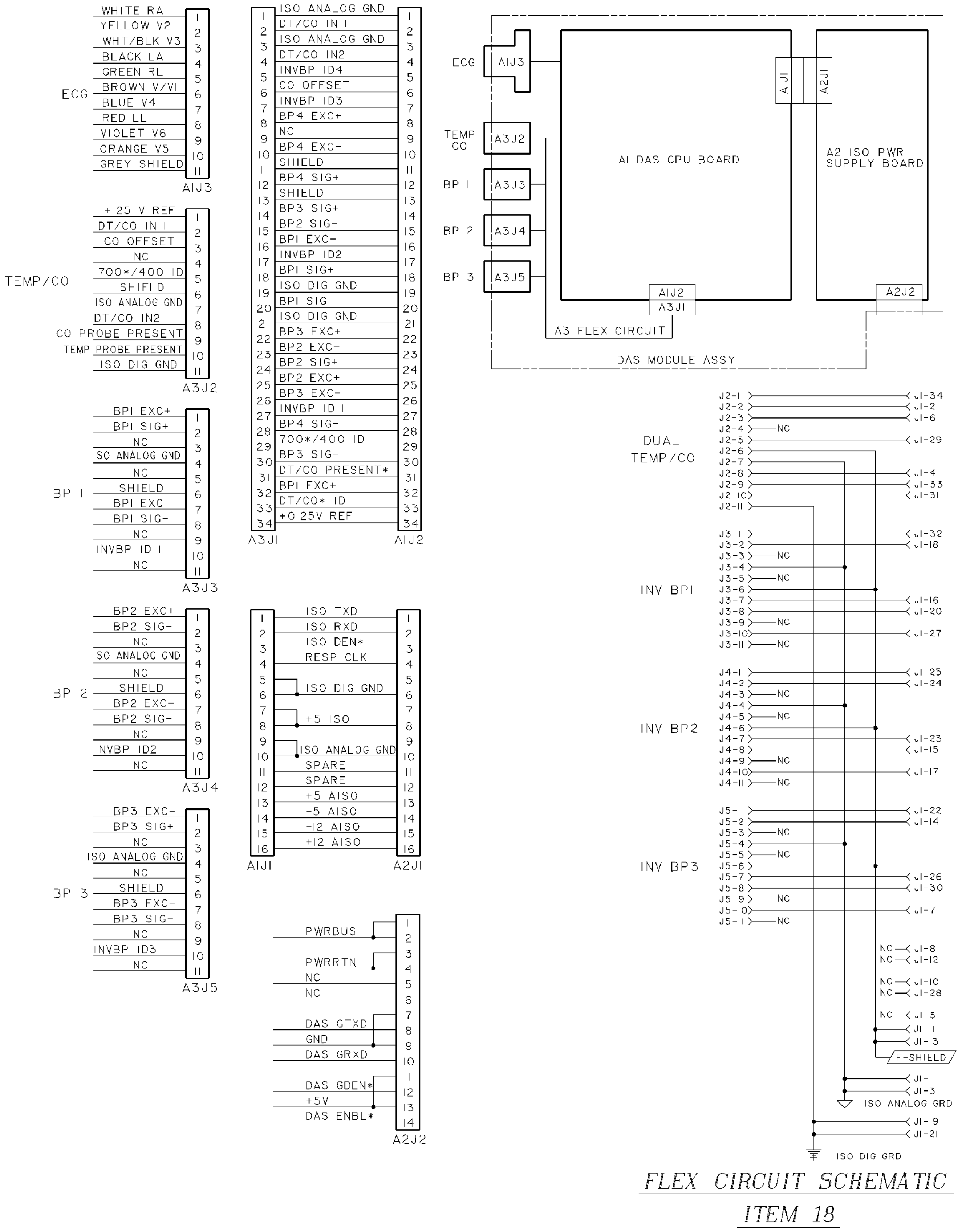
NOTES

1) EDGE OF SHIELD ITEM 12 TO BE FLUSH WITH EDGE OF PCB ASSY ITEM 3 OR 11

2) CONNECTORS, ITEMS 19 AND 20 SNAP INTO CONNECTOR PANEL, ITEM 17 BEFORE SOLDERING FLEX CIRCUIT, ITEM 18 IN PLACE

3) MARK LABEL (ITEM 22) AS FOLLOWS
WARNING
TRAM TYPE MUST BE
SET WHEN DAS MODULE
IS EXCHANGED

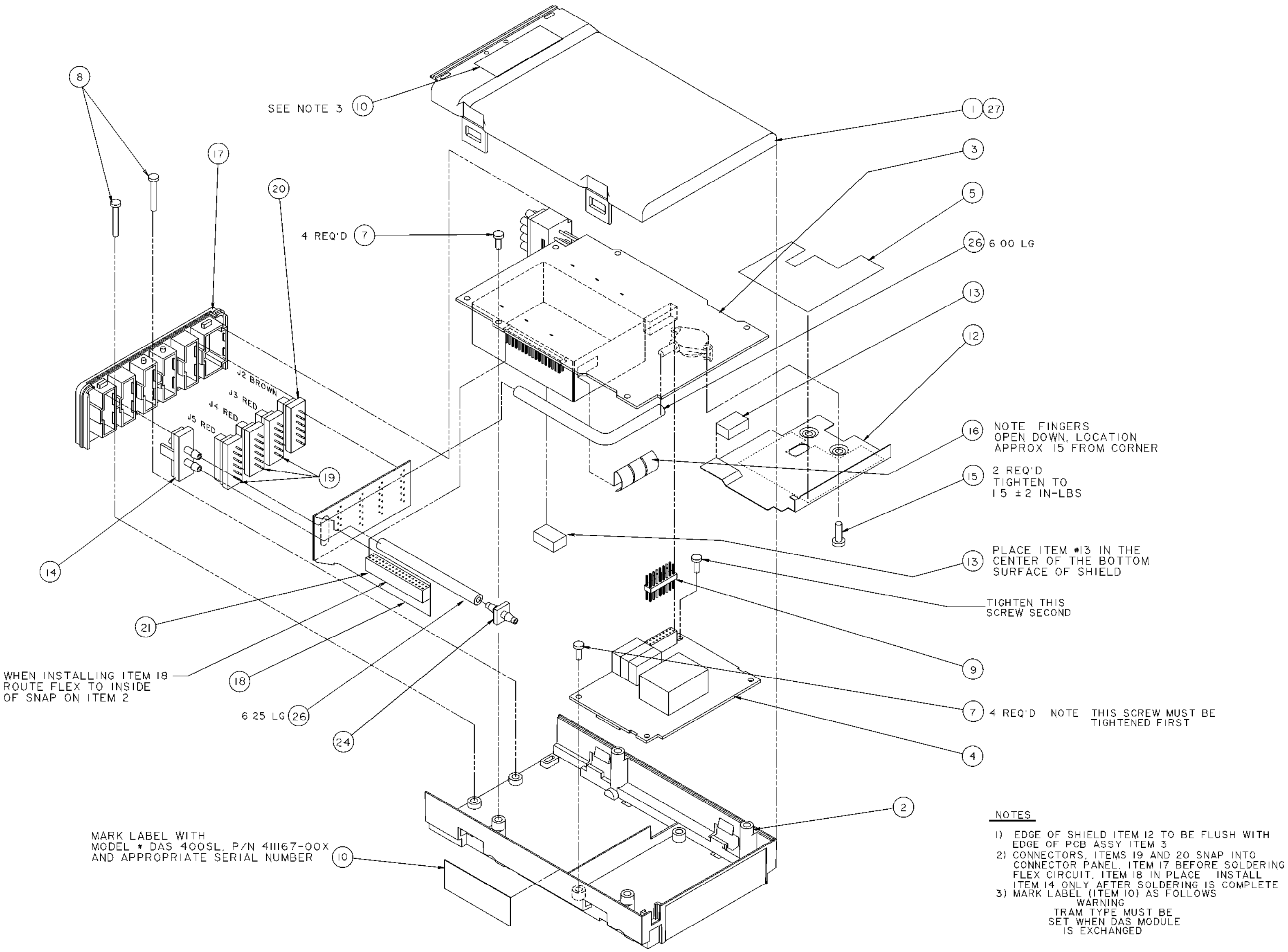
# Schematic Diagram PN 410495-001D


ECG
WHITE RA
YELLOW V2
WHT/BLK V3
BLACK LA
GREEN RL
BROWN V/VI
BLUE V4
RED LL
VIOLET V6
ORANGE V5
GREY SHIELD
AIJ3
TEMP/CO
+ 25 V REF
DT/CO IN I
CO OFFSET
NC
700*/400 ID
SHIELD
ISO ANALOG GND
DT/CO IN2
CO PROBE PRESENT
TEMP PROBE PRESENT
ISO DIG GND
A3J2
BP I
BPI EXC+
BPI SIG+
NC
ISO ANALOG GND
NC
SHIELD
BPI EXC-
BPI SIG-
NC
INVBP ID I
NC
A3J3
BP 2
BP2 EXC+
BP2 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP2 EXC-
BP2 SIG-
NC
INVBP ID2
NC
A3J4
BP 3
BP3 EXC+
BP3 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP3 EXC-
BP3 SIG-
NC
INVBP ID3
NC
A3J5
ISO ANALOG GND
DT/CO IN I
ISO ANALOG GND
DT/CO IN2
INVBP ID4
CO OFFSET
INVBP ID3
BP4 EXC+
NC
BP4 EXC-
SHIELD
BP4 SIG+
SHIELD
BP3 SIG+
BP2 SIG-
BPI EXC-
INVBP ID2
BPI SIG+
ISO DIG GND
BPI SIG-
ISO DIG GND
BP3 EXC+
BP2 EXC-
BP2 SIG+
BP2 EXC+
BP3 EXC-
INVBP ID I
BP4 SIG-
700*/400 ID
BP3 SIG-
DT/CO PRESENT*
BPI EXC+
DT/CO* ID
+0 25V REF
A3JI
AIJ2
ISO TXD
ISO RXD
ISO DEN*
RESP CLK
ISO DIG GND
+5 ISO
ISO ANALOG GND
SPARE
SPARE
+5 AISO
-5 AISO
-I2 AISO
+I2 AISO
AIJI
A2JI
PWRBUS
PWRRTN
NC
NC
DAS GTXD
GND
DAS GRXD
DAS GDEN*
+5V
DAS ENBL*
A2J2
ECG
AIJ3
TEMP CO
A3J2
BP I
A3J3
BP 2
A3J4
BP 3
A3J5
AI DAS CPU BOARD
AIJI
A2JI
A2 ISO-PWR SUPPLY BOARD
AIJ2
A3JI
A2J2
A3 FLEX CIRCUIT
DAS MODULE ASSY
DUAL TEMP/CO
J2-I JI-34
J2-2 JI-2
J2-3 JI-6
J2-4 NC
J2-5 JI-29
J2-6
J2-7
J2-8 JI-4
J2-9 JI-33
J2-10 JI-31
J2-II
INV BPI
J3-I JI-32
J3-2 JI-18
J3-3 NC
J3-4
J3-5 NC
J3-6
J3-7 JI-16
J3-8 JI-20
J3-9 NC
J3-10 JI-27
J3-II NC
INV BP2
J4-I JI-25
J4-2 JI-24
J4-3 NC
J4-4
J4-5 NC
J4-6
J4-7 JI-23
J4-8 JI-15
J4-9 NC
J4-10 JI-17
J4-II NC
INV BP3
J5-I JI-22
J5-2 JI-14
J5-3 NC
J5-4
J5-5 NC
J5-6
J5-7 JI-26
J5-8 JI-30
J5-9 NC
J5-10 JI-7
J5-II NC
NC JI-8
NC JI-12
NC JI-10
NC JI-28
NC JI-5
JI-II
JI-13
F-SHIELD
JI-I
JI-3
ISO ANALOG GRD
JI-19
JI-2I
ISO DIG GRD
FLEX CIRCUIT SCHEMATIC
ITEM 18

# Module Parts List PN 410495-001D

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 1 | | Cover, Top | 401311-001 | 1 |
| 2 | | Cover, Lower | 401681-001 | 1 |
| 3 | A1 | Acquisition Processor PCB, 5-Lead, 3-BP, W/NBP | 800330-009 | 1 |
| 4 | A2 | Isolated Power Supply PCB | 402329-002 | 1 |
| 5 | | Insulator | 408417-001 | 1 |
| 6 | | Shield, Hybrids | 403283-002 | 1 |
| 7 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 45074-406 | 8 |
| 8 | | Screw, 4-40 x 7/8 | 404069-001 | 2 |
| 9 | A1J1, A2J1 | Header, Vertical, 16-Pin | 1778-916 | 1 |
| 10 | | Label, Model/Serial Number | 404525-006 | 1 |
| 12 | | Shield, Acquisition Processor PCB, Lower | 405517-001 | 1 |
| 13 | | Tape, Foam | 4819-102 | AR |
| 14 | | NBP Connector Socket | 414640-002 | |
| 15 | | Screw, BDGH, Phillips, 6-32 x 7/16 | 45074-918 | 2 |
| 16 | | Spring, Chassis Ground, Rear | 403741-001 | AR |
| 17 | | Isolated Connector Panel, Tram 400/500/600 Module | 402159-001 | 1 |
| 18 | A3 | Flex Circuit, BP/Temp | 800397-002 | 1 |
| 19 | A3J3, A3J4, A3J5 | Connector, BP (Red) | 401762-004 | 3 |
| 20 | A3J2 | Connector, TEMP/CO (Brown) | 401762-021 | 1 |
| 21 | A3J1 | Connector, 34-Pin, Horizontal | 17020-034 | 1 |
| 22 | | Label (Marked with "WARNING, TRAM TYPE MUST BE SET WHEN DAS MODULE IS EXCHANGED") | 404525-001 | 1 |
| 24 | | Connector, Pneumatic | 404445-001 | 1 |
| 25 | | Fitting, Adapter, 10-32 to 1/8-Inch ID | 4745-201 | 2 |
| 26 | | Tubing, Silastic | 401582-001 | AR |

# Exploded View PN 411167-001C


1
27
3
5
26
6 00 LG
13
12
16
15
13
9
7
4
2
10
7
8
17
20
19
J2 BROWN
J3 RED
J4 RED
J5 RED
14
21
18
26
6 25 LG
24
10

SEE NOTE 3

4 REQ'D

NOTE FINGERS
OPEN DOWN, LOCATION
APPROX I5 FROM CORNER

2 REQ'D
TIGHTEN TO
I 5 ±2 IN-LBS

PLACE ITEM #I3 IN THE
CENTER OF THE BOTTOM
SURFACE OF SHIELD

TIGHTEN THIS
SCREW SECOND

4 REQ'D NOTE THIS SCREW MUST BE
TIGHTENED FIRST

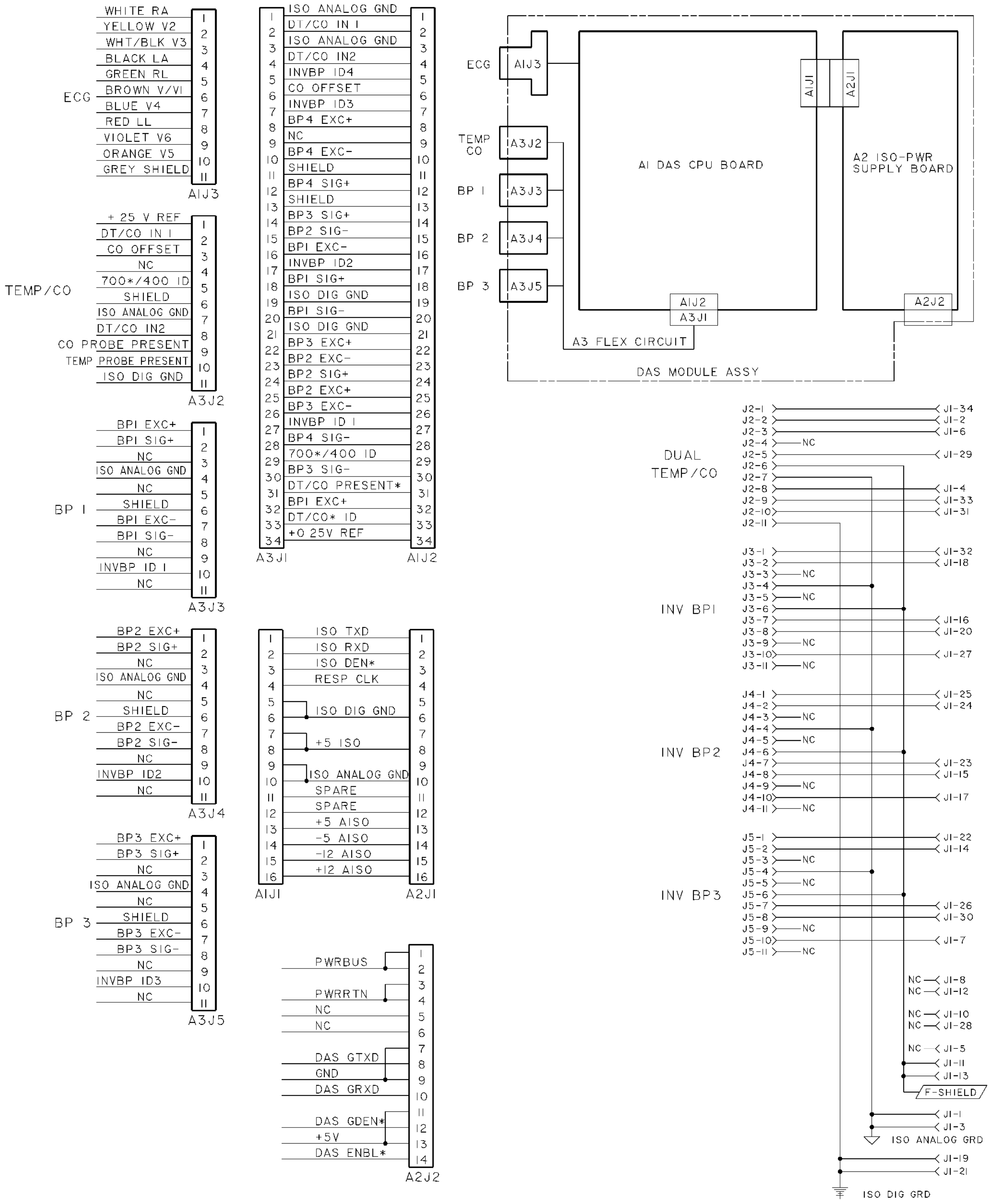
WHEN INSTALLING ITEM I8
ROUTE FLEX TO INSIDE
OF SNAP ON ITEM 2

MARK LABEL WITH
MODEL # DAS 400SL, P/N 4II67-00X
AND APPROPRIATE SERIAL NUMBER

NOTES

1) EDGE OF SHIELD ITEM I2 TO BE FLUSH WITH
EDGE OF PCB ASSY ITEM 3
2) CONNECTORS, ITEMS I9 AND 20 SNAP INTO
CONNECTOR PANEL, ITEM I7 BEFORE SOLDERING
FLEX CIRCUIT, ITEM I8 IN PLACE INSTALL
ITEM I4 ONLY AFTER SOLDERING IS COMPLETE
3) MARK LABEL (ITEM I0) AS FOLLOWS
WARNING
TRAM TYPE MUST BE
SET WHEN DAS MODULE
IS EXCHANGED

# Schematic Diagram PN 411167-001C


ECG
WHITE RA
YELLOW V2
WHT/BLK V3
BLACK LA
GREEN RL
BROWN V/VI
BLUE V4
RED LL
VIOLET V6
ORANGE V5
GREY SHIELD
A1J3
TEMP/CO
+ 25 V REF
DT/CO IN 1
CO OFFSET
NC
700*/400 ID
SHIELD
ISO ANALOG GND
DT/CO IN2
CO PROBE PRESENT
TEMP PROBE PRESENT
ISO DIG GND
A3J2
BP 1
BP1 EXC+
BP1 SIG+
BP1 EXC-
BP1 SIG-
INVBP ID 1
A3J3
BP 2
BP2 EXC+
BP2 SIG+
BP2 EXC-
BP2 SIG-
INVBP ID2
A3J4
BP 3
BP3 EXC+
BP3 SIG+
BP3 EXC-
BP3 SIG-
INVBP ID3
A3J5
ISO ANALOG GND
DT/CO IN 1
ISO ANALOG GND
DT/CO IN2
INVBP ID4
CO OFFSET
INVBP ID3
BP4 EXC+
NC
BP4 EXC-
SHIELD
BP4 SIG+
SHIELD
BP3 SIG+
BP2 SIG-
BP1 EXC-
INVBP ID2
BP1 SIG+
ISO DIG GND
BP1 SIG-
ISO DIG GND
BP3 EXC+
BP2 EXC-
BP2 SIG+
BP2 EXC+
BP3 EXC-
INVBP ID 1
BP4 SIG-
700*/400 ID
BP3 SIG-
DT/CO PRESENT*
BP1 EXC+
DT/CO* ID
+0 25V REF
A3J1
A1J2
ISO TXD
ISO RXD
ISO DEN*
RESP CLK
ISO DIG GND
+5 ISO
ISO ANALOG GND
SPARE
SPARE
+5 AISO
-5 AISO
-12 AISO
+12 AISO
A1J1
A2J1
PWRBUS
PWRRTN
NC
NC
DAS GTXD
GND
DAS GRXD
DAS GDEN*
+5V
DAS ENBL*
A2J2
ECG
A1J3
TEMP CO
A3J2
BP 1
A3J3
BP 2
A3J4
BP 3
A3J5
A1J1
A2J1
A1 DAS CPU BOARD
A2 ISO-PWR SUPPLY BOARD
A1J2
A3J1
A2J2
A3 FLEX CIRCUIT
DAS MODULE ASSY
DUAL TEMP/CO
INV BP1
INV BP2
INV BP3
J2-1 J1-34
J2-2 J1-2
J2-3 J1-6
J2-4 NC
J2-5 J1-29
J2-8 J1-4
J2-9 J1-33
J2-10 J1-31
J3-1 J1-32
J3-2 J1-18
J3-7 J1-16
J3-8 J1-20
J3-10 J1-27
J4-1 J1-25
J4-2 J1-24
J4-7 J1-23
J4-8 J1-15
J4-10 J1-17
J5-1 J1-22
J5-2 J1-14
J5-7 J1-26
J5-8 J1-30
J5-10 J1-7
NC J1-8
NC J1-12
NC J1-10
NC J1-28
NC J1-5
J1-11
J1-13
F-SHIELD
J1-1
J1-3
ISO ANALOG GRD
J1-19
J1-21
ISO DIG GRD

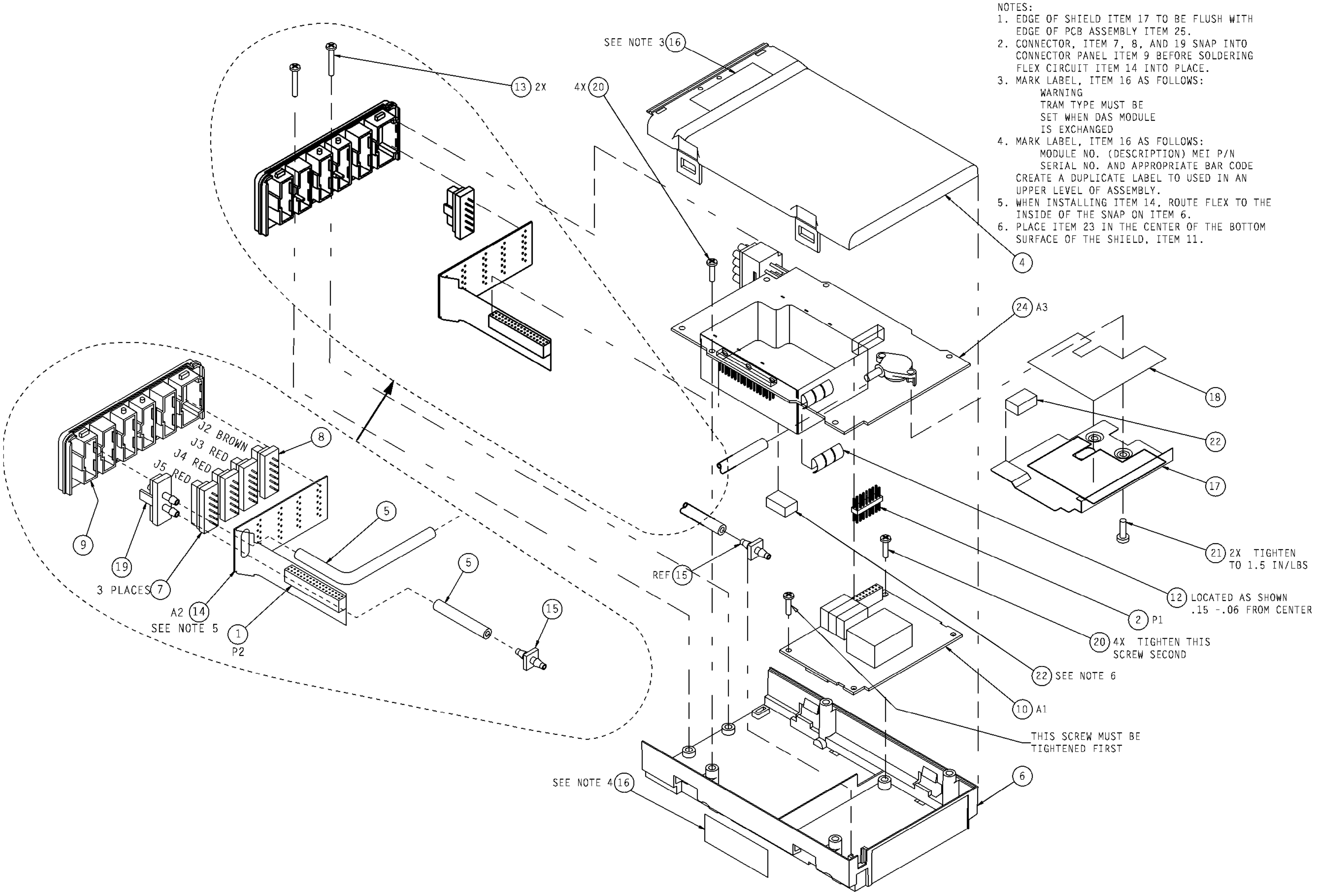
*FLEX CIRCUIT SCHEMATIC*

*ITEM 18*

# Parts List PN 411167-001C

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 1 | | Cover, Top | 401311-001 | 0 |
| 2 | | Cover, Lower | 401681-001 | 0 |
| 3 | A1 | Acquisition Processor PCB, 10-Lead, 3-BP, W/NBP | 800330-010 | 1 |
| 4 | A2 | Isolated Power Supply PCB | 402329-002 | 1 |
| 5 | | Insulator | 408417-001 | 1 |
| 7 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 45074-406 | 8 |
| 8 | | Screw, 4-40 x 7/8 | 404069-001 | 2 |
| 9 | | Header, Vertical, 16-Pin | 1778-916 | 1 |
| 10 | | Label (Marked with “WARNING TRAM TYPE MUST BE SET WHEN DAS MODULE IS EXCHANGED”) | 404525-001 | 2 |
| 12 | | Shield, Acquisition Processor PCB, Lower | 405517-001 | 1 |
| 13 | | Tape, Foam | 4819-102 | 2 |
| 14 | | Connector, Pneumatic, NBP, Recessed | 409376-002 | 1 |
| 15 | | Screw, BDGH, Phillips, 6-32 x 1/2 | 45074-917 | 2 |
| 16 | | Spring, Chassis Ground, Rear | 403741-001 | AR |
| 17 | | Isolated Connector Panel, Tram 400/500/600 Module | 402159-001 | 1 |
| 18 | A3 | Flex Circuit, BP/Temp | 800397-002 | 1 |
| 19 | | Connector, BP (Red) | 401762-004 | 3 |
| 20 | | Connector, TEMP/CO (Brown) | 401762-021 | 1 |
| 21 | | Connector, 34-Pin, Horizontal | 17020-034 | 1 |
| 24 | | Connector, Pneumatic | 404445-001 | 1 |
| 26 | | Tubing, Silastic | 401582-001 | AR |

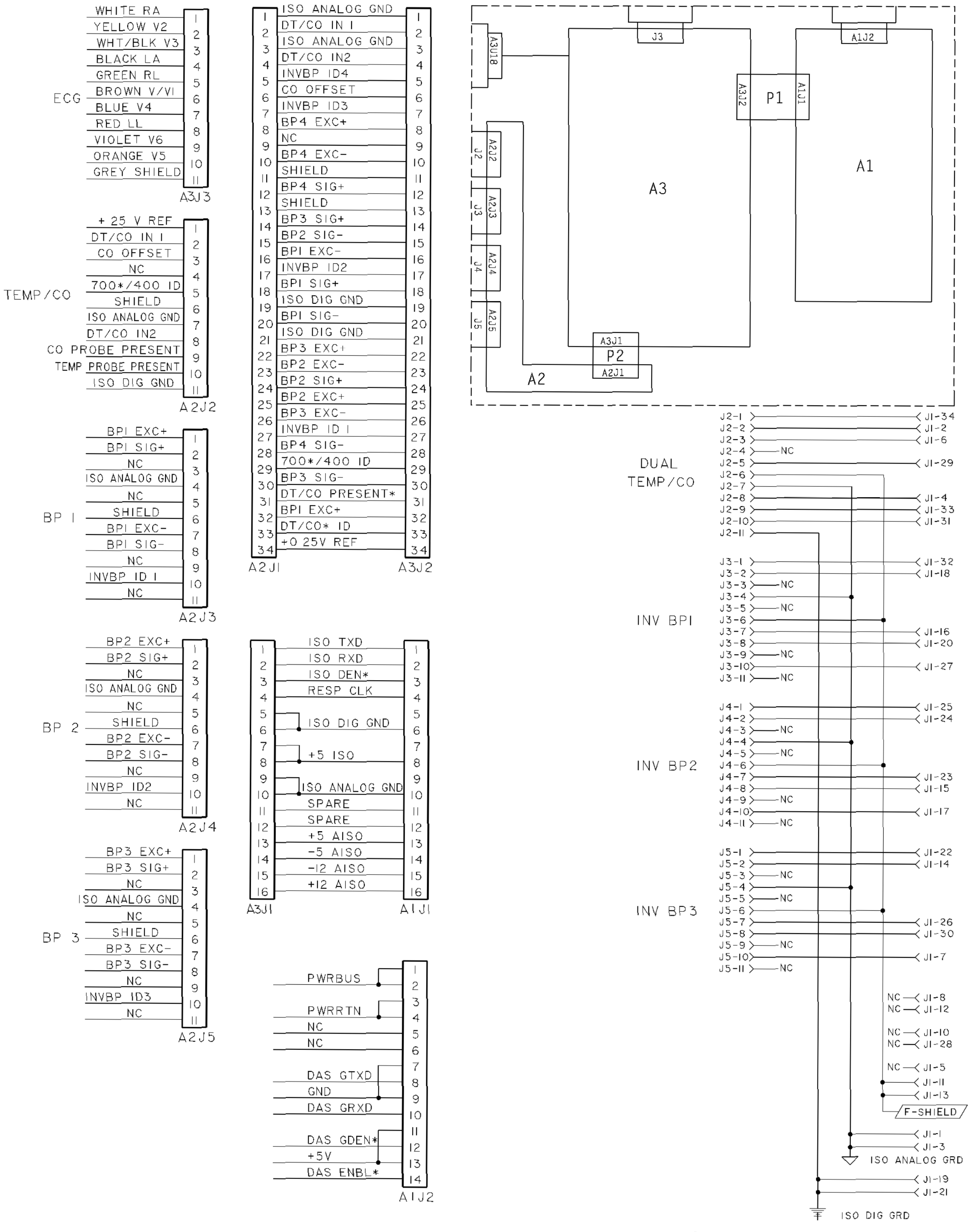
# Exploded View PN 417121-001B



NOTES:
1. EDGE OF SHIELD ITEM 17 TO BE FLUSH WITH EDGE OF PCB ASSEMBLY ITEM 25.
2. CONNECTOR, ITEM 7, 8, AND 19 SNAP INTO CONNECTOR PANEL ITEM 9 BEFORE SOLDERING FLEX CIRCUIT ITEM 14 INTO PLACE.
3. MARK LABEL, ITEM 16 AS FOLLOWS:
   WARNING
   TRAM TYPE MUST BE
   SET WHEN DAS MODULE
   IS EXCHANGED
4. MARK LABEL, ITEM 16 AS FOLLOWS:
   MODULE NO. (DESCRIPTION) MEI P/N
   SERIAL NO. AND APPROPRIATE BAR CODE
   CREATE A DUPLICATE LABEL TO USED IN AN UPPER LEVEL OF ASSEMBLY.
5. WHEN INSTALLING ITEM 14, ROUTE FLEX TO THE INSIDE OF THE SNAP ON ITEM 6.
6. PLACE ITEM 23 IN THE CENTER OF THE BOTTOM SURFACE OF THE SHIELD, ITEM 11.

SEE NOTE 3 (16)
(13) 2X
4X (20)
(4)
(24) A3
(18)
(22)
(17)
(21) 2X TIGHTEN TO 1.5 IN/LBS
(12) LOCATED AS SHOWN .15 -.06 FROM CENTER
(2) P1
(20) 4X TIGHTEN THIS SCREW SECOND
(22) SEE NOTE 6
(10) A1
THIS SCREW MUST BE TIGHTENED FIRST
(6)
SEE NOTE 4 (16)
REF (15)
(15)
(5)
(5)
(8)
J2 BROWN
J3 RED
J4 RED
J5 RED
(9)
(19)
3 PLACES (7)
A2 (14)
SEE NOTE 5
(1)
P2

# Schematic Diagram PN 417121-001B


ECG
WHITE RA
YELLOW V2
WHT/BLK V3
BLACK LA
GREEN RL
BROWN V/VI
BLUE V4
RED LL
VIOLET V6
ORANGE V5
GREY SHIELD
A3J3
TEMP/CO
+ 25 V REF
DT/CO IN I
CO OFFSET
NC
700*/400 ID
SHIELD
ISO ANALOG GND
DT/CO IN2
CO PROBE PRESENT
TEMP PROBE PRESENT
ISO DIG GND
A2J2
BP I
BPI EXC+
BPI SIG+
NC
ISO ANALOG GND
NC
SHIELD
BPI EXC-
BPI SIG-
NC
INVBP ID I
NC
A2J3
BP 2
BP2 EXC+
BP2 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP2 EXC-
BP2 SIG-
NC
INVBP ID2
NC
A2J4
BP 3
BP3 EXC+
BP3 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP3 EXC-
BP3 SIG-
NC
INVBP ID3
NC
A2J5
ISO ANALOG GND
DT/CO IN I
ISO ANALOG GND
DT/CO IN2
INVBP ID4
CO OFFSET
INVBP ID3
BP4 EXC+
NC
BP4 EXC-
SHIELD
BP4 SIG+
SHIELD
BP3 SIG+
BP2 SIG-
BPI EXC-
INVBP ID2
BPI SIG+
ISO DIG GND
BPI SIG-
ISO DIG GND
BP3 EXC+
BP2 EXC-
BP2 SIG+
BP2 EXC+
BP3 EXC-
INVBP ID I
BP4 SIG-
700*/400 ID
BP3 SIG-
DT/CO PRESENT*
BPI EXC+
DT/CO* ID
+0 25V REF
A2JI
A3J2
ISO TXD
ISO RXD
ISO DEN*
RESP CLK
ISO DIG GND
+5 ISO
ISO ANALOG GND
SPARE
SPARE
+5 AISO
-5 AISO
-12 AISO
+12 AISO
A3JI
AIJI
PWRBUS
PWRRTN
NC
NC
DAS GTXD
GND
DAS GRXD
DAS GDEN*
+5V
DAS ENBL*
AIJ2
A3U18
J3
A1J2
A3J2
P1
A1J1
J2
A2J2
J3
A2J3
J4
A2J4
J5
A2J5
A3
A1
A3J1
P2
A2J1
A2
DUAL TEMP/CO
J2-1 J1-34
J2-2 J1-2
J2-3 J1-6
J2-4 NC
J2-5 J1-29
J2-6
J2-7
J2-8 J1-4
J2-9 J1-33
J2-10 J1-31
J2-11
INV BPI
J3-1 J1-32
J3-2 J1-18
J3-3 NC
J3-4
J3-5 NC
J3-6
J3-7 J1-16
J3-8 J1-20
J3-9 NC
J3-10 J1-27
J3-11 NC
INV BP2
J4-1 J1-25
J4-2 J1-24
J4-3 NC
J4-4
J4-5 NC
J4-6
J4-7 J1-23
J4-8 J1-15
J4-9 NC
J4-10 J1-17
J4-11 NC
INV BP3
J5-1 J1-22
J5-2 J1-14
J5-3 NC
J5-4
J5-5 NC
J5-6
J5-7 J1-26
J5-8 J1-30
J5-9 NC
J5-10 J1-7
J5-11 NC
NC J1-8
NC J1-12
NC J1-10
NC J1-28
NC J1-5
J1-11
J1-13
F-SHIELD
J1-1
J1-3
ISO ANALOG GRD
J1-19
J1-21
ISO DIG GRD

*FLEX CIRCUIT SCHEMATIC*

# Parts List PN 417121-001B

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 1 | P2 | Connector, 34-Pin, Horizontal | 17020-034 | 1 |
| 2 | P1 | Header, Vertical, 16-Pin | 1778-916 | 1 |
| 4 | | Cover, Top | 401311-001 | 1 |
| 5 | | Tubing, Silastic | 401582-001 | AR |
| 6 | | Cover, Lower | 401681-001 | 1 |
| 7 | | Connector, BP (Red) | 401762-004 | 3 |
| 8 | | Connector, TEMP/CO (Brown) | 401762-021 | 1 |
| 9 | | Isolated Connector Panel, Tram 400/500/600 Module | 402159-001 | 1 |
| 10 | A1 | Isolated Power Supply PCB | 402329-002 | 1 |
| 12 | | Spring, Chassis Ground, Rear | 403741-001 | AR |
| 13 | | Screw, 4-40 x 7/8 | 404069-001 | 2 |
| 14 | A2 | Flex Circuit, BP/Temp | 800397-002 | 1 |
| 15 | | Connector, Pneumatic | 404445-001 | 1 |
| 16 | | Label (Marked with "WARNING, TRAM TYPE MUST BE SET WHEN DAS MODULE IS EXCHANGED") | 404525-001 | 2 |
| 17 | | Shield, Acquisition Processor PCB, Lower | 405517-001 | 1 |
| 18 | | Insulator | 408417-001 | 1 |
| 19 | | Socket, NBP w/o Key | 414640-002 | 1 |
| 20 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 45074-406 | 8 |
| 21 | | Screw, BDGH, Phillips, 6-32 x 1/2 | 45074-917 | 2 |
| 22 | | Tape, Foam | 4819-102 | 2 |
| 24 | A3 | Acquisition Processor PCB, 10-Lead, 2-BP, W/NBP | 801040-001 | 1 |

*For your notes*

# 19 500/600 ACQUISITION MODULE PN 408133/411168/417122

**General** .......... **19-2**
Safety .......... 19-2
Assembly Configurations .......... 19-2

**Exploded View PN 408133-001A/002A** .......... **19-3**

**Schematic Diagram PN 408133-001A/002A** .......... **19-4**

**Parts List PN 408133-001A/002A** .......... **19-5**

**Exploded View PN 411168-001C** .......... **19-6**

**Schematic Diagram PN 411168-001C** .......... **19-7**

**Parts List PN 411168-001C** .......... **19-8**

**Exploded View PN 417122-001B** .......... **19-9**

**Schematic Diagram PN 417122-001B** .......... **19-10**

**Parts List PN 417122-001B** .......... **19-11**

# General

## Safety

Observe the following warning:

---

**WARNING**
The data acquisition module contains the isolation barrier between the patient and the rest of the module. If the data acquisition module is removed, repaired, or replaced for any reason, the module must undergo the current leakage and hi-pot tests listed in Chapter 5: "Preventive Maintenance" before being used on a patient. These tests verify the integrity of the isolation barrier, and are necessary to ensure continued safe operation. Failure to perform the tests may cause undue equipment failure and possible health hazards.

---

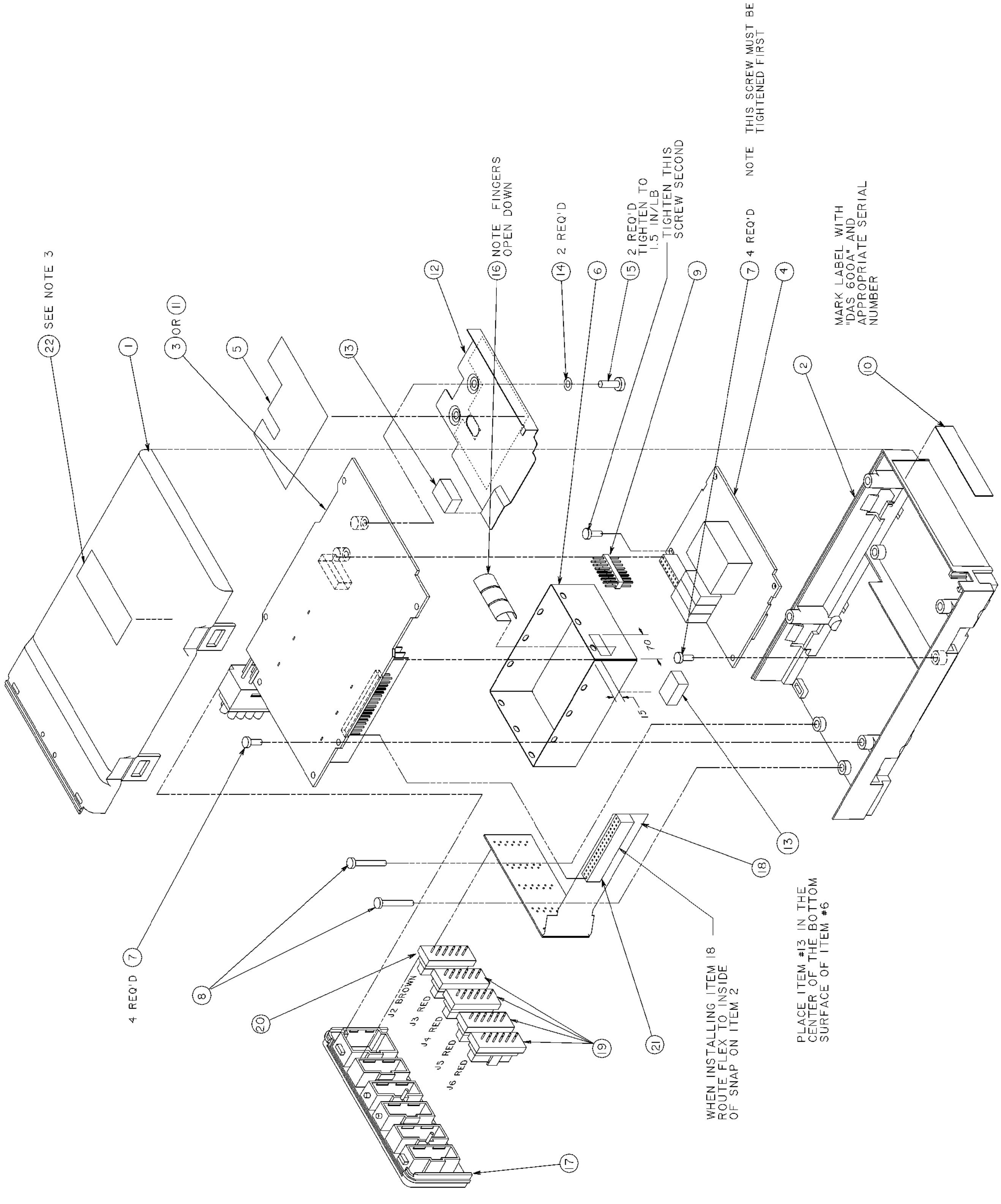
## Assembly Configurations

There are four configurations of the data acquisition module described in this chapter. The difference between the assemblies is in the number of ECG leadwires monitored and the acquisition processor PCB used in the DAS module itself. Use the table below to determine which parts lists to use in this manual for your Tram module.

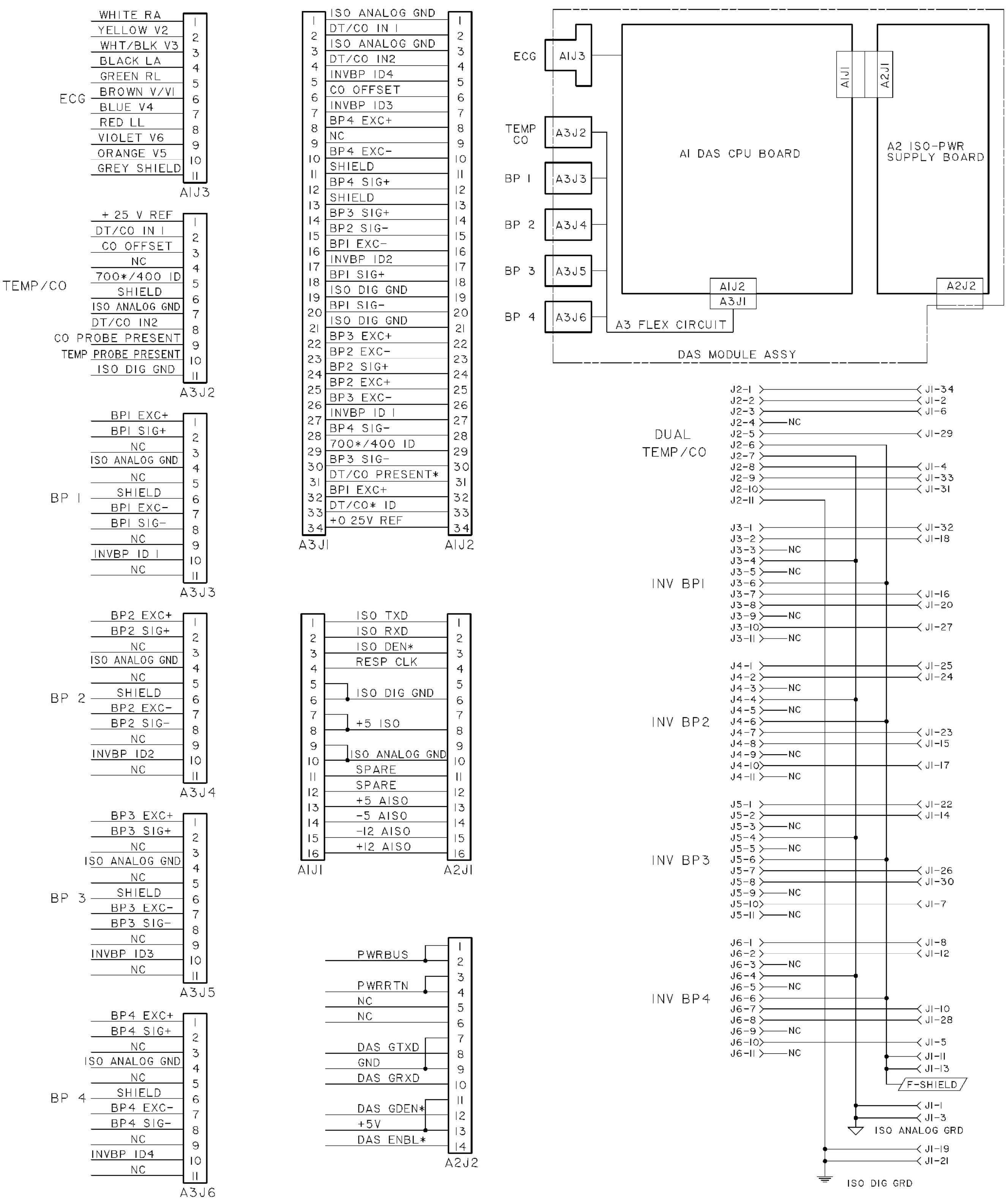
**Table 19-1. DAS Module Configurations**

| Module Type | Leadwire Configuration | DAS Module | Acquisition Processor PCB |
|---|---|---|---|
| Tram 500A | 5-Leadwire | 408133-001 | 800330-002 |
| Tram 600A | 5-Leadwire | 408133-002 | 800330-004 |
| Tram 600SL | 10-Leadwire | 411168-001 | 800330-004 |
| Tram 600SL | 10-Leadwire | 417122-001 (Replaced 411168-001) | 801040-001 |
| Tram 650SL | 10-Leadwire | 411168-001 | 800330-004 |
| Tram 650SL | 10-Leadwire | 417122-001 (Replaced 411168-001) | 801040-001 |

# Exploded View PN 408133-001A/002A


22 SEE NOTE 3
1
3 OR 11
5
13
12
16 NOTE FINGERS OPEN DOWN
14 2 REQ'D
6
15 2 REQ'D TIGHTEN TO 1.5 IN/LB
TIGHTEN THIS SCREW SECOND
9
7 4 REQ'D
NOTE THIS SCREW MUST BE TIGHTENED FIRST
4
MARK LABEL WITH "DAS 600A" AND APPROPRIATE SERIAL NUMBER
2
10
70
15
13
18
PLACE ITEM #13 IN THE CENTER OF THE BOTTOM SURFACE OF ITEM #6
WHEN INSTALLING ITEM 18 ROUTE FLEX TO INSIDE OF SNAP ON ITEM 2
21
19
J2 BROWN
J3 RED
J4 RED
J5 RED
J6 RED
20
8
7
4 REQ'D
17

# Schematic Diagram PN 408133-001A/002A


ECG
WHITE RA 1
YELLOW V2 2
WHT/BLK V3 3
BLACK LA 4
GREEN RL 5
BROWN V/V1 6
BLUE V4 7
RED LL 8
VIOLET V6 9
ORANGE V5 10
GREY SHIELD 11
A1J3
TEMP/CO
+ 25 V REF 1
DT/CO IN 1 2
CO OFFSET 3
NC 4
700*/400 ID 5
SHIELD 6
ISO ANALOG GND 7
DT/CO IN2 8
CO PROBE PRESENT 9
TEMP PROBE PRESENT 10
ISO DIG GND 11
A3J2
BP 1
BP1 EXC+ 1
BP1 SIG+ 2
NC 3
ISO ANALOG GND 4
NC 5
SHIELD 6
BP1 EXC- 7
BP1 SIG- 8
NC 9
INVBP ID 1 10
NC 11
A3J3
BP 2
BP2 EXC+ 1
BP2 SIG+ 2
NC 3
ISO ANALOG GND 4
NC 5
SHIELD 6
BP2 EXC- 7
BP2 SIG- 8
NC 9
INVBP ID2 10
NC 11
A3J4
BP 3
BP3 EXC+ 1
BP3 SIG+ 2
NC 3
ISO ANALOG GND 4
NC 5
SHIELD 6
BP3 EXC- 7
BP3 SIG- 8
NC 9
INVBP ID3 10
NC 11
A3J5
BP 4
BP4 EXC+ 1
BP4 SIG+ 2
NC 3
ISO ANALOG GND 4
NC 5
SHIELD 6
BP4 EXC- 7
BP4 SIG- 8
NC 9
INVBP ID4 10
NC 11
A3J6
1 ISO ANALOG GND 1
2 DT/CO IN 1 2
3 ISO ANALOG GND 3
4 DT/CO IN2 4
5 INVBP ID4 5
6 CO OFFSET 6
7 INVBP ID3 7
8 BP4 EXC+ 8
9 NC 9
10 BP4 EXC- 10
11 SHIELD 11
12 BP4 SIG+ 12
13 SHIELD 13
14 BP3 SIG+ 14
15 BP2 SIG- 15
16 BP1 EXC- 16
17 INVBP ID2 17
18 BP1 SIG+ 18
19 ISO DIG GND 19
20 BP1 SIG- 20
21 ISO DIG GND 21
22 BP3 EXC+ 22
23 BP2 EXC- 23
24 BP2 SIG+ 24
25 BP2 EXC+ 25
26 BP3 EXC- 26
27 INVBP ID 1 27
28 BP4 SIG- 28
29 700*/400 ID 29
30 BP3 SIG- 30
31 DT/CO PRESENT* 31
32 BP1 EXC+ 32
33 DT/CO* ID 33
34 +0 25V REF 34
A3J1
A1J2
1 ISO TXD 1
2 ISO RXD 2
3 ISO DEN* 3
4 RESP CLK 4
5 6 ISO DIG GND 5 6
7 8 +5 ISO 7 8
9 10 ISO ANALOG GND 9 10
11 SPARE 11
12 SPARE 12
13 +5 AISO 13
14 -5 AISO 14
15 -12 AISO 15
16 +12 AISO 16
A1J1
A2J1
PWRBUS 1 2
PWRRTN 3 4
NC 5
NC 6
DAS GTXD 7
GND 8
DAS GRXD 9
DAS GDEN* 10 11
+5V 12
DAS ENBL* 13 14
A2J2
ECG A1J3
TEMP CO A3J2
BP 1 A3J3
BP 2 A3J4
BP 3 A3J5
BP 4 A3J6
A1 DAS CPU BOARD
A1J1
A2J1
A2 ISO-PWR SUPPLY BOARD
A1J2
A3J1
A2J2
A3 FLEX CIRCUIT
DAS MODULE ASSY
DUAL TEMP/CO
J2-1 J1-34
J2-2 J1-2
J2-3 J1-6
J2-4 NC
J2-5 J1-29
J2-6
J2-7
J2-8 J1-4
J2-9 J1-33
J2-10 J1-31
J2-11
INV BP1
J3-1 J1-32
J3-2 J1-18
J3-3 NC
J3-4
J3-5 NC
J3-6
J3-7 J1-16
J3-8 J1-20
J3-9 NC
J3-10 J1-27
J3-11 NC
INV BP2
J4-1 J1-25
J4-2 J1-24
J4-3 NC
J4-4
J4-5 NC
J4-6
J4-7 J1-23
J4-8 J1-15
J4-9 NC
J4-10 J1-17
J4-11 NC
INV BP3
J5-1 J1-22
J5-2 J1-14
J5-3 NC
J5-4
J5-5 NC
J5-6
J5-7 J1-26
J5-8 J1-30
J5-9 NC
J5-10 J1-7
J5-11 NC
INV BP4
J6-1 J1-8
J6-2 J1-12
J6-3 NC
J6-4
J6-5 NC
J6-6
J6-7 J1-10
J6-8 J1-28
J6-9 NC
J6-10 J1-5
J6-11 NC
J1-11
J1-13
F-SHIELD
J1-1
J1-3
ISO ANALOG GRD
J1-19
J1-21
ISO DIG GRD

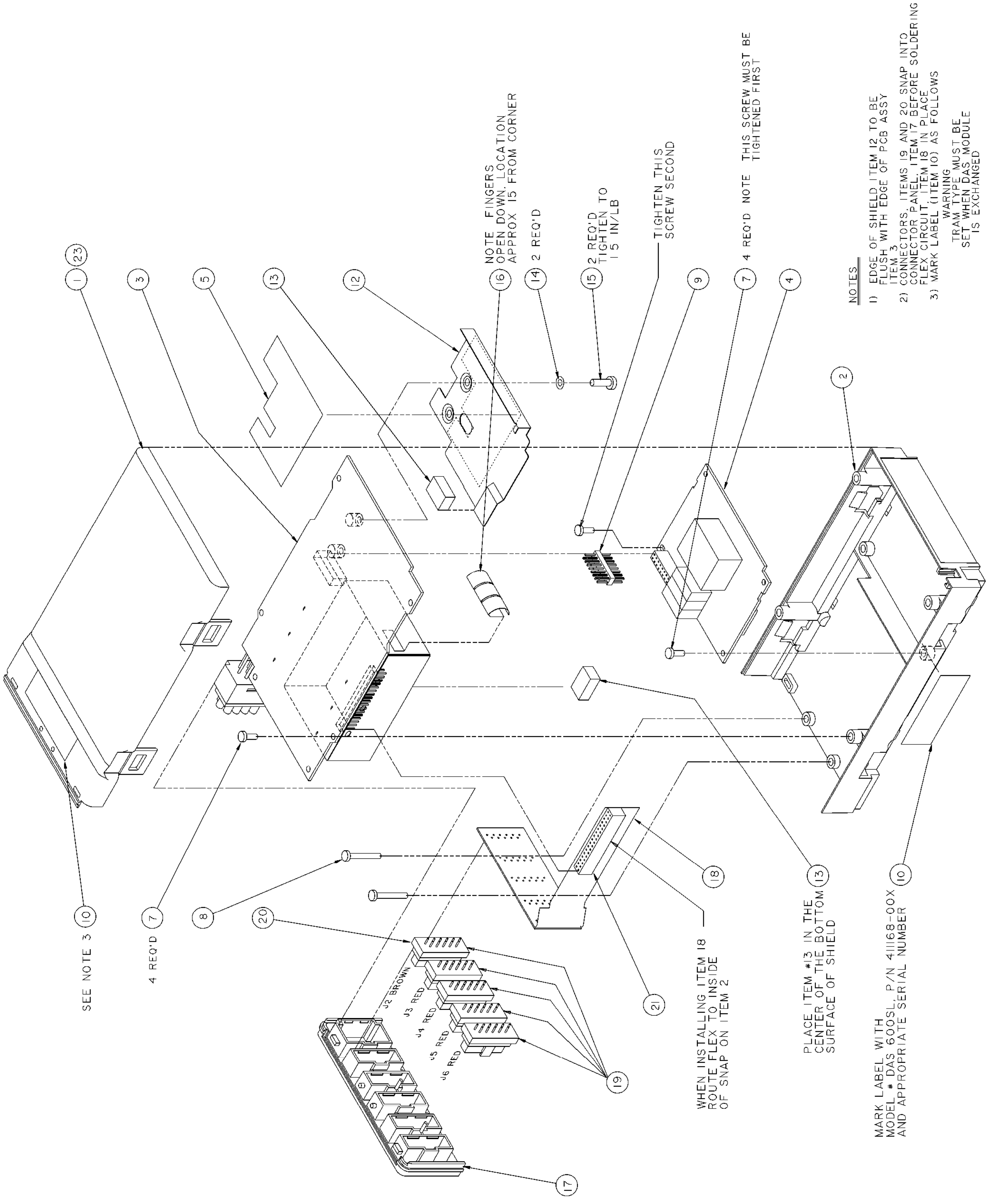
*FLEX CIRCUIT SCHEMATIC*

*ITEM 18*

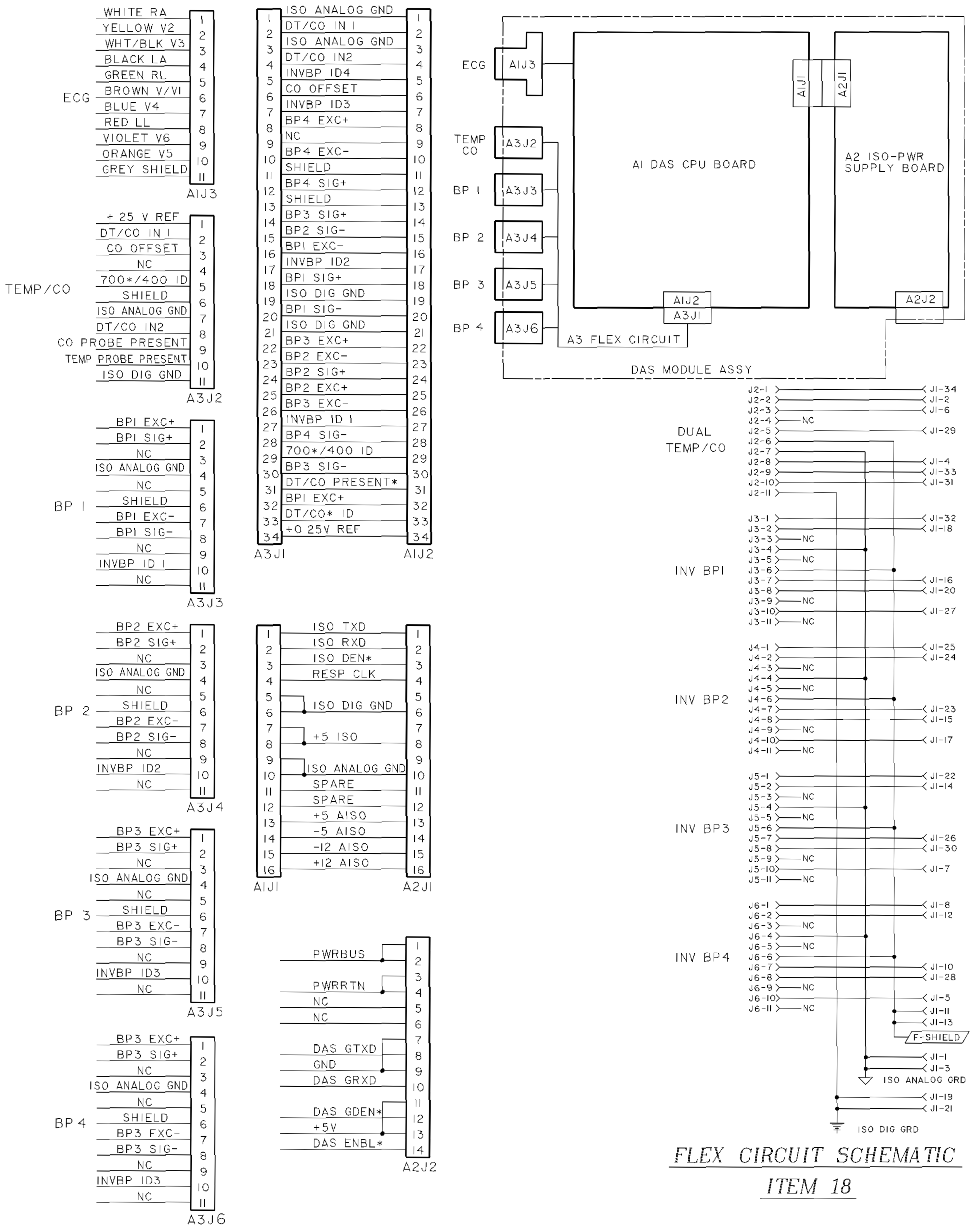
# Parts List PN 408133-001A/002A

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 1 | | Cover, Top | 401311-001 | 1 |
| 2 | | Cover, Lower | 401681-001 | 1 |
| 3 | A1 | Acquisition Processor PCB, 5-Lead, 4-BP (For PN 408133-001 Only) | 800330-002 | 1 |
| 4 | A2 | Isolated Power Supply PCB | 402329-002 | 1 |
| 5 | | Insulator | 408417-001 | 1 |
| 6 | | Shield, Hybrids | 403283-002 | 1 |
| 7 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 45074-406 | 8 |
| 8 | | Screw, 4-40 x 7/8 | 404069-001 | 2 |
| 9 | A1J1, A2J1 | Header, Vertical, 16-Pin | 1778-916 | 1 |
| 10 | | Label, Model/Serial Number | 404525-006 | 1 |
| 11 | A1 | Acquisition Processor PCB, 5-Lead, 4-BP (For PN 408133-002 Only) | 800330-004 | 1 |
| 12 | | Shield, Acquisition Processor PCB, Lower | 405517-001 | 1 |
| 13 | | Tape, Foam | 4819-102 | AR |
| 14 | | Washer, Nylon, Flat, No 6 | 4550-130 | 2 |
| 15 | | Screw, BDGH, Phillips, 6-32 x 3/16 | 45074-606 | 2 |
| 16 | | Spring, Chassis Ground, Rear | 403741-001 | AR |
| 17 | | Isolated Connector Panel, Tram 400/500/600 Module | 402159-001 | 1 |
| 18 | A3 | Flex Circuit, BP/Temp | 404109-001 | 1 |
| 19 | A3J2 | Connector, BP (Red) | 401762-004 | 4 |
| 20 | A3J3 – A3J6 | Connector, TEMP/CO (Brown) | 401762-021 | 1 |
| 21 | A3J1 | Connector, 34-Pin, Horizontal | 17020-034 | 1 |
| 22 | | Label (Marked with "WARNING, TRAM TYPE MUST BE SET WHEN DAS MODULE IS EXCHANGED") | 404525-001 | 1 |

# Exploded View PN 411168-001C


NOTES
1) EDGE OF SHIELD ITEM 12 TO BE FLUSH WITH EDGE OF PCB ASSY ITEM 3
2) CONNECTORS, ITEMS 19 AND 20 SNAP INTO CONNECTOR PANEL, ITEM 17 BEFORE SOLDERING FLEX CIRCUIT, ITEM 18 IN PLACE
3) MARK LABEL (ITEM 10) AS FOLLOWS
WARNING
TRAM TYPE MUST BE SET WHEN DAS MODULE IS EXCHANGED
1
23
3
5
13
12
16 NOTE FINGERS OPEN DOWN, LOCATION APPROX 15 FROM CORNER
14 2 REQ'D
15 2 REQ'D TIGHTEN TO 15 IN/LB
TIGHTEN THIS SCREW SECOND
9
7 4 REQ'D NOTE THIS SCREW MUST BE TIGHTENED FIRST
4
2
SEE NOTE 3 10
4 REQ'D 7
8
20
J2 BROWN
J3 RED
J4 RED
J5 RED
J6 RED
19
17
21
WHEN INSTALLING ITEM 18 ROUTE FLEX TO INSIDE OF SNAP ON ITEM 2
18
PLACE ITEM #13 IN THE CENTER OF THE BOTTOM SURFACE OF SHIELD
13
MARK LABEL WITH MODEL # DAS 600SL, P/N 411168-00X AND APPROPRIATE SERIAL NUMBER
10

# Schematic Diagram PN 411168-001C


ECG
1 WHITE RA
2 YELLOW V2
3 WHT/BLK V3
4 BLACK LA
5 GREEN RL
6 BROWN V/V1
7 BLUE V4
8 RED LL
9 VIOLET V6
10 ORANGE V5
11 GREY SHIELD
A1J3
TEMP/CO
1 + 25 V REF
2 DT/CO IN 1
3 CO OFFSET
4 NC
5 700*/400 ID
6 SHIELD
7 ISO ANALOG GND
8 DT/CO IN2
9 CO PROBE PRESENT
10 TEMP PROBE PRESENT
11 ISO DIG GND
A3J2
BP 1
1 BP1 EXC+
2 BP1 SIG+
3 NC
4 ISO ANALOG GND
5 NC
6 SHIELD
7 BP1 EXC-
8 BP1 SIG-
9 NC
10 INVBP ID 1
11 NC
A3J3
BP 2
1 BP2 EXC+
2 BP2 SIG+
3 NC
4 ISO ANALOG GND
5 NC
6 SHIELD
7 BP2 EXC-
8 BP2 SIG-
9 NC
10 INVBP ID2
11 NC
A3J4
BP 3
1 BP3 EXC+
2 BP3 SIG+
3 NC
4 ISO ANALOG GND
5 NC
6 SHIELD
7 BP3 EXC-
8 BP3 SIG-
9 NC
10 INVBP ID3
11 NC
A3J5
BP 4
1 BP3 EXC+
2 BP3 SIG+
3 NC
4 ISO ANALOG GND
5 NC
6 SHIELD
7 BP3 FXC-
8 BP3 SIG-
9 NC
10 INVBP ID3
11 NC
A3J6
1 ISO ANALOG GND
2 DT/CO IN 1
3 ISO ANALOG GND
4 DT/CO IN2
5 INVBP ID4
6 CO OFFSET
7 INVBP ID3
8 BP4 EXC+
9 NC
10 BP4 EXC-
11 SHIELD
12 BP4 SIG+
13 SHIELD
14 BP3 SIG+
15 BP2 SIG-
16 BP1 EXC-
17 INVBP ID2
18 BP1 SIG+
19 ISO DIG GND
20 BP1 SIG-
21 ISO DIG GND
22 BP3 EXC+
23 BP2 EXC-
24 BP2 SIG+
25 BP2 EXC+
26 BP3 EXC-
27 INVBP ID 1
28 BP4 SIG-
29 700*/400 ID
30 BP3 SIG-
31 DT/CO PRESENT*
32 BP1 EXC+
33 DT/CO* ID
34 +0 25V REF
A3J1
A1J2
1 ISO TXD
2 ISO RXD
3 ISO DEN*
4 RESP CLK
5 6 ISO DIG GND
7 8 +5 ISO
9 10 ISO ANALOG GND
11 SPARE
12 SPARE
13 +5 AISO
14 -5 AISO
15 -12 AISO
16 +12 AISO
A1J1
A2J1
1 2 PWRBUS
3 4 PWRRTN
5 NC
6 NC
7 DAS GTXD
8 9 GND
10 DAS GRXD
11 DAS GDEN*
12 13 +5V
14 DAS ENBL*
A2J2
ECG
A1J3
TEMP CO
A3J2
BP 1
A3J3
BP 2
A3J4
BP 3
A3J5
BP 4
A3J6
A1J1
A2J1
A1 DAS CPU BOARD
A2 ISO-PWR SUPPLY BOARD
A1J2
A3J1
A2J2
A3 FLEX CIRCUIT
DAS MODULE ASSY
DUAL TEMP/CO
J2-1 J1-34
J2-2 J1-2
J2-3 J1-6
J2-4 NC
J2-5 J1-29
J2-6
J2-7
J2-8 J1-4
J2-9 J1-33
J2-10 J1-31
J2-11
INV BP1
J3-1 J1-32
J3-2 J1-18
J3-3 NC
J3-4
J3-5 NC
J3-6
J3-7 J1-16
J3-8 J1-20
J3-9 NC
J3-10 J1-27
J3-11 NC
INV BP2
J4-1 J1-25
J4-2 J1-24
J4-3 NC
J4-4
J4-5 NC
J4-6
J4-7 J1-23
J4-8 J1-15
J4-9 NC
J4-10 J1-17
J4-11 NC
INV BP3
J5-1 J1-22
J5-2 J1-14
J5-3 NC
J5-4
J5-5 NC
J5-6
J5-7 J1-26
J5-8 J1-30
J5-9 NC
J5-10 J1-7
J5-11 NC
INV BP4
J6-1 J1-8
J6-2 J1-12
J6-3 NC
J6-4
J6-5 NC
J6-6
J6-7 J1-10
J6-8 J1-28
J6-9 NC
J6-10 J1-5
J6-11 NC
J1-11
J1-13
F-SHIELD
J1-1
J1-3
ISO ANALOG GRD
J1-19
J1-21
ISO DIG GRD

*FLEX CIRCUIT SCHEMATIC*

*ITEM 18*

# Parts List PN 411168-001C

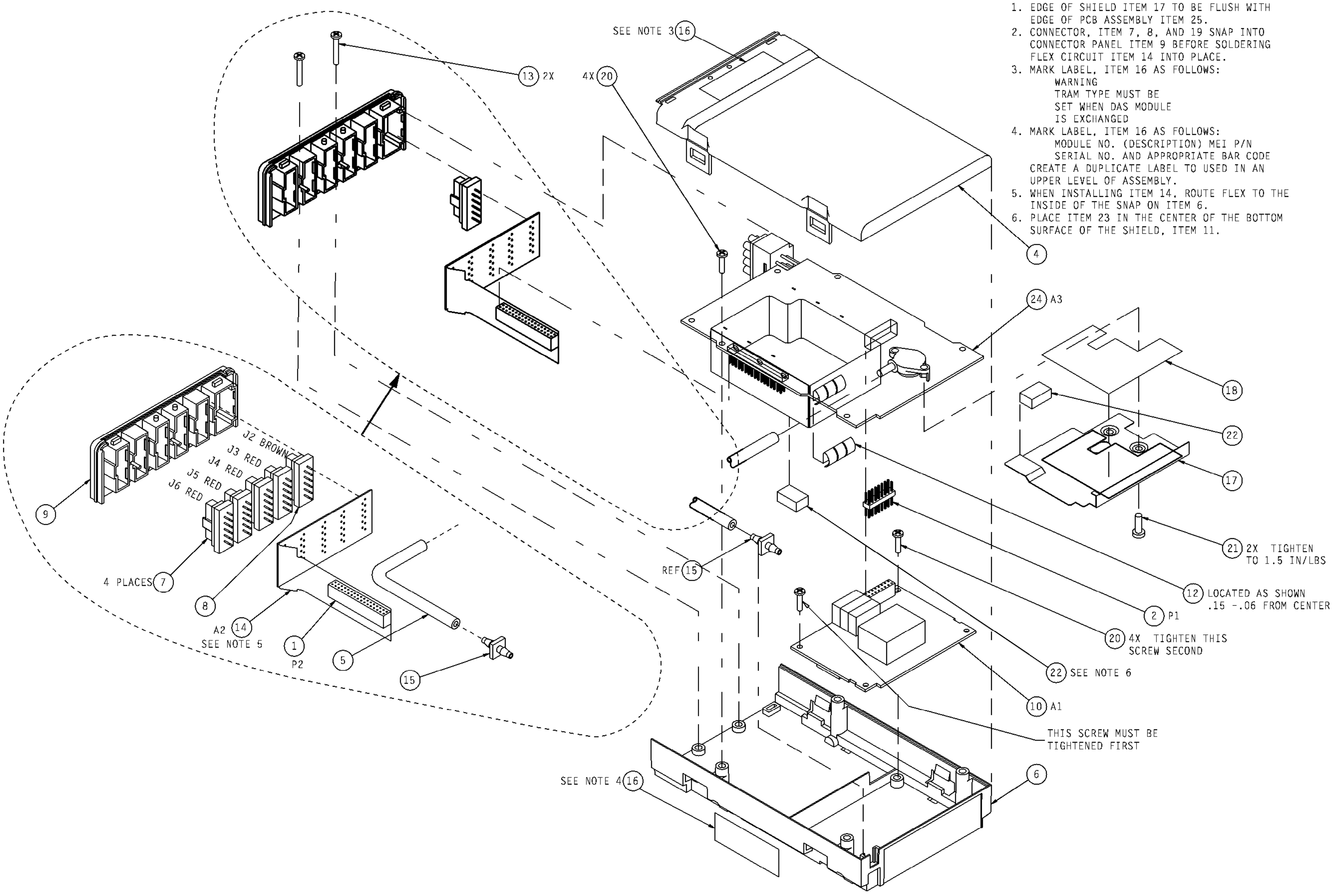
| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 1 | | Cover, Top | 401311-001 | 0 |
| 2 | | Cover, Lower | 401681-001 | 0 |
| 3 | A1 | Acquisition Processor PCB, 10-Lead, 4-BP | 800330-004 | 1 |
| 4 | A2 | Isolated Power Supply PCB | 402329-002 | 1 |
| 5 | | Insulator | 408417-001 | 1 |
| 6 | | Shield, Hybrids | 403283-002 | 1 |
| 7 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 45074-406 | 8 |
| 8 | | Screw, 4-40 x 7/8 | 404069-001 | 2 |
| 9 | | Header, Vertical, 16-Pin | 1778-916 | 1 |
| 10 | | Label (Marked with "WARNING, TRAM TYPE MUST BE SET WHEN DAS MODULE IS EXCHANGED") | 404525-001 | 2 |
| 12 | | Shield, Acquisition Processor PCB, Lower | 405517-001 | 1 |
| 13 | | Tape, Foam | 4819-102 | 2 |
| 14 | | Washer, Nylon, Flat, No 6 | 4550-130 | 2 |
| 15 | | Screw, BDGH, Phillips, 6-32 x 3/16 | 45074-606 | 2 |
| 16 | | Spring, Chassis Ground, Rear | 403741-001 | AR |
| 17 | | Isolated Connector Panel, Tram 400/500/600 Module | 402159-001 | 1 |
| 18 | A3 | Flex Circuit, BP/Temp | 404109-001 | 1 |
| 19 | | Connector, BP (Red) | 401762-004 | 4 |
| 20 | | Connector, TEMP/CO (Brown) | 401762-021 | 1 |
| 21 | | Connector, 34-Pin, Horizontal | 17020-034 | 1 |

# Exploded View

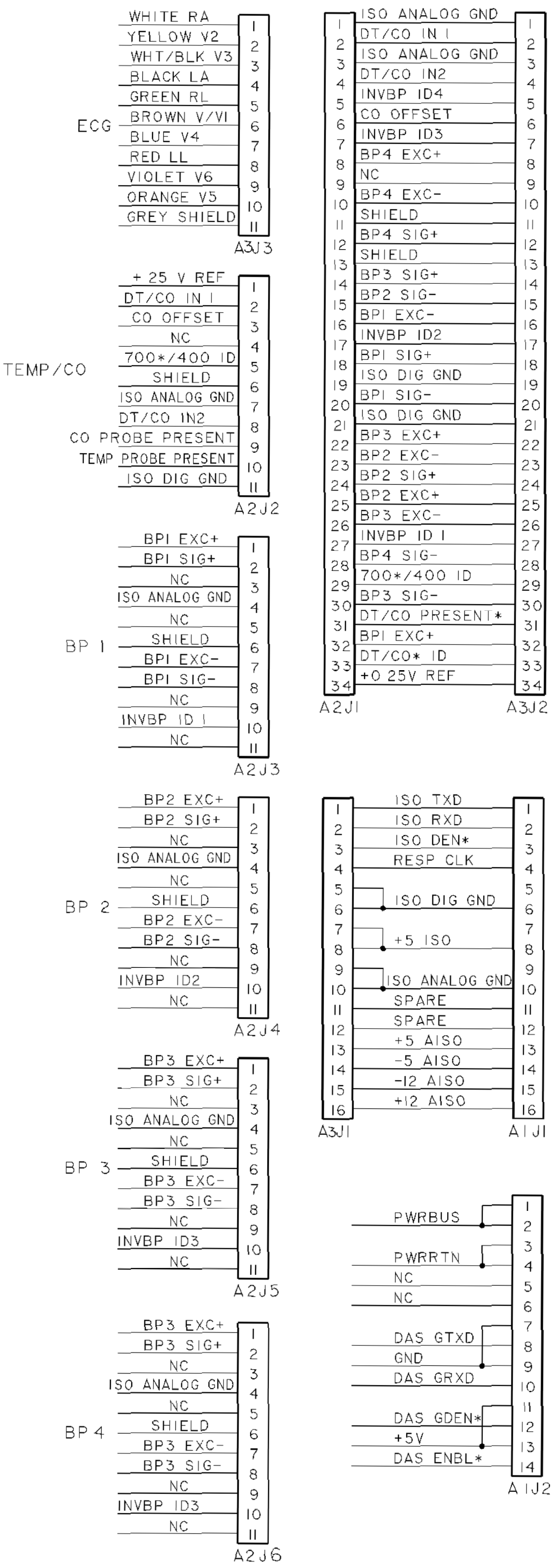
# PN 417122-001B

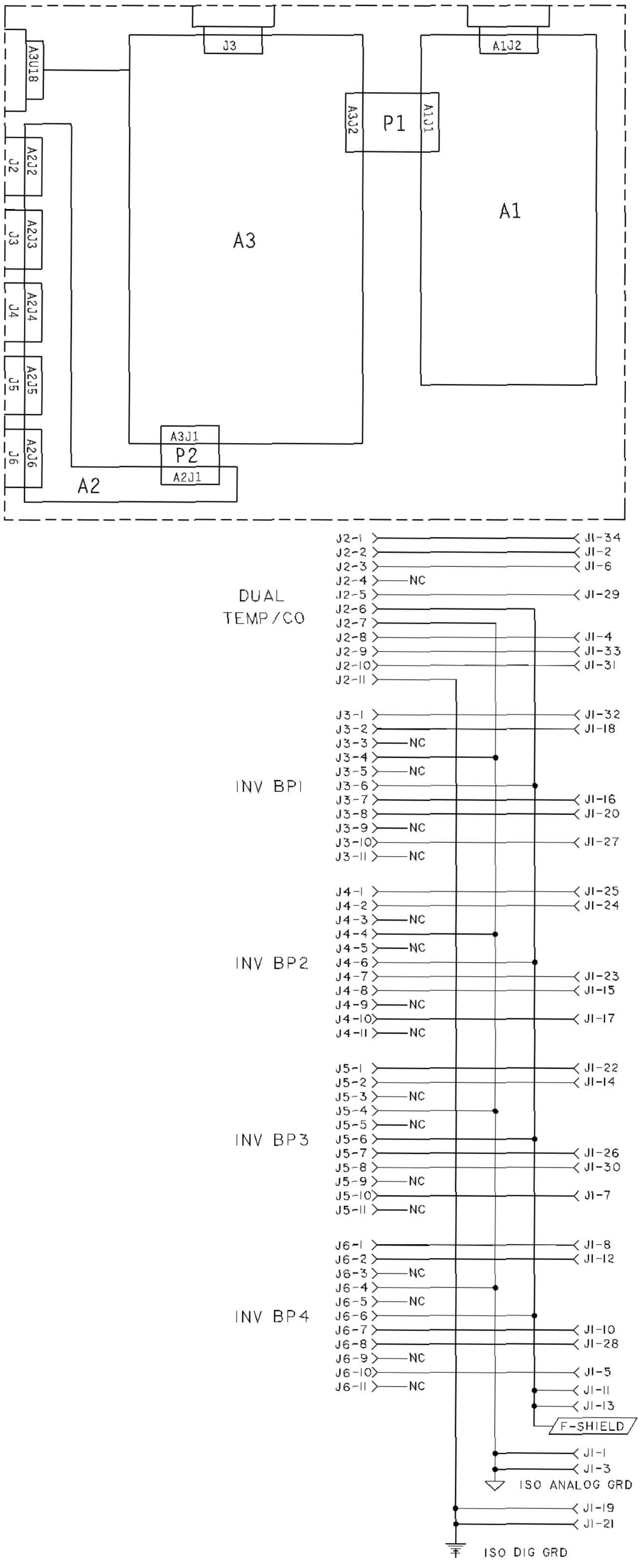
NOTES:

1. EDGE OF SHIELD ITEM 17 TO BE FLUSH WITH EDGE OF PCB ASSEMBLY ITEM 25.
2. CONNECTOR, ITEM 7, 8, AND 19 SNAP INTO CONNECTOR PANEL ITEM 9 BEFORE SOLDERING FLEX CIRCUIT ITEM 14 INTO PLACE.
3. MARK LABEL, ITEM 16 AS FOLLOWS:
   WARNING
   TRAM TYPE MUST BE
   SET WHEN DAS MODULE
   IS EXCHANGED
4. MARK LABEL, ITEM 16 AS FOLLOWS:
   MODULE NO. (DESCRIPTION) MEI P/N
   SERIAL NO. AND APPROPRIATE BAR CODE
   CREATE A DUPLICATE LABEL TO USED IN AN UPPER LEVEL OF ASSEMBLY.
5. WHEN INSTALLING ITEM 14, ROUTE FLEX TO THE INSIDE OF THE SNAP ON ITEM 6.
6. PLACE ITEM 23 IN THE CENTER OF THE BOTTOM SURFACE OF THE SHIELD, ITEM 11.


SEE NOTE 3 16
13 2X
4X 20
4
24 A3
18
22
17
21 2X TIGHTEN
TO 1.5 IN/LBS
12 LOCATED AS SHOWN
.15 -.06 FROM CENTER
2 P1
20 4X TIGHTEN THIS
SCREW SECOND
22 SEE NOTE 6
10 A1
THIS SCREW MUST BE
TIGHTENED FIRST
6
SEE NOTE 4 16
REF 15
J2 BROWN
J3 RED
J4 RED
J5 RED
J6 RED
9
4 PLACES 7
8
A2 14
SEE NOTE 5
1
P2
5
15

# Schematic Diagram PN 417122-001B


ECG
WHITE RA
YELLOW V2
WHT/BLK V3
BLACK LA
GREEN RL
BROWN V/V1
BLUE V4
RED LL
VIOLET V6
ORANGE V5
GREY SHIELD
A3J3
TEMP/CO
+ 25 V REF
DT/CO IN 1
CO OFFSET
NC
700*/400 ID
SHIELD
ISO ANALOG GND
DT/CO IN2
CO PROBE PRESENT
TEMP PROBE PRESENT
ISO DIG GND
A2J2
BP 1
BP1 EXC+
BP1 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP1 EXC-
BP1 SIG-
NC
INVBP ID 1
NC
A2J3
BP 2
BP2 EXC+
BP2 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP2 EXC-
BP2 SIG-
NC
INVBP ID2
NC
A2J4
BP 3
BP3 EXC+
BP3 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP3 EXC-
BP3 SIG-
NC
INVBP ID3
NC
A2J5
BP 4
BP3 EXC+
BP3 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP3 EXC-
BP3 SIG-
NC
INVBP ID3
NC
A2J6
ISO ANALOG GND
DT/CO IN 1
ISO ANALOG GND
DT/CO IN2
INVBP ID4
CO OFFSET
INVBP ID3
BP4 EXC+
NC
BP4 EXC-
SHIELD
BP4 SIG+
SHIELD
BP3 SIG+
BP2 SIG-
BP1 EXC-
INVBP ID2
BP1 SIG+
ISO DIG GND
BP1 SIG-
ISO DIG GND
BP3 EXC+
BP2 EXC-
BP2 SIG+
BP2 EXC+
BP3 EXC-
INVBP ID 1
BP4 SIG-
700*/400 ID
BP3 SIG-
DT/CO PRESENT*
BP1 EXC+
DT/CO* ID
+0 25V REF
A2J1
A3J2
ISO TXD
ISO RXD
ISO DEN*
RESP CLK
ISO DIG GND
+5 ISO
ISO ANALOG GND
SPARE
SPARE
+5 AISO
-5 AISO
-12 AISO
+12 AISO
A3J1
A1J1
PWRBUS
PWRRTN
NC
NC
DAS GTXD
GND
DAS GRXD
DAS GDEN*
+5V
DAS ENBL*
A1J2


A3U18
J3
A1J2
A3J2
P1
A1J1
A2J2
J2
A2J3
J3
A2J4
J4
A2J5
J5
A2J6
J6
A3
A1
A3J1
P2
A2J1
A2
DUAL TEMP/CO
J2-1 J1-34
J2-2 J1-2
J2-3 J1-6
J2-4 NC
J2-5 J1-29
J2-6
J2-7
J2-8 J1-4
J2-9 J1-33
J2-10 J1-31
J2-11
INV BP1
J3-1 J1-32
J3-2 J1-18
J3-3 NC
J3-4
J3-5 NC
J3-6
J3-7 J1-16
J3-8 J1-20
J3-9 NC
J3-10 J1-27
J3-11 NC
INV BP2
J4-1 J1-25
J4-2 J1-24
J4-3 NC
J4-4
J4-5 NC
J4-6
J4-7 J1-23
J4-8 J1-15
J4-9 NC
J4-10 J1-17
J4-11 NC
INV BP3
J5-1 J1-22
J5-2 J1-14
J5-3 NC
J5-4
J5-5 NC
J5-6
J5-7 J1-26
J5-8 J1-30
J5-9 NC
J5-10 J1-7
J5-11 NC
INV BP4
J6-1 J1-8
J6-2 J1-12
J6-3 NC
J6-4
J6-5 NC
J6-6
J6-7 J1-10
J6-8 J1-28
J6-9 NC
J6-10 J1-5
J6-11 NC
J1-11
J1-13
F-SHIELD
J1-1
J1-3
ISO ANALOG GRD
J1-19
J1-21
ISO DIG GRD

*FLEX CIRCUIT SCHEMATIC*

# Parts List PN 417122-001B

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 1 | P2 | Connector, 34-Pin, Horizontal | 17020-034 | 1 |
| 2 | P1 | Header, Vertical, 16-Pin | 1778-916 | 1 |
| 4 | | Cover, Top | 401311-001 | 1 |
| 6 | | Cover, Lower | 401681-001 | 1 |
| 7 | | Connector, BP (Red) | 401762-004 | 4 |
| 8 | | Connector, TEMP/CO (Brown) | 401762-021 | 1 |
| 9 | | Isolated Connector Panel, Tram 400/500/600 Module | 402159-001 | 1 |
| 10 | A1 | Isolated Power Supply PCB | 402329-002 | 1 |
| 12 | | Spring, Chassis Ground, Rear | 403741-001 | AR |
| 13 | | Screw, 4-40 x 7/8 | 404069-001 | 2 |
| 14 | A2 | Flex Circuit, BP/Temp | 404109-001 | 1 |
| 16 | | Label (Marked with "WARNING, TRAM TYPE MUST BE SET WHEN DAS MODULE IS EXCHANGED") | 404525-001 | 2 |
| 17 | | Shield, Acquisition Processor PCB, Lower | 405517-001 | 1 |
| 18 | | Insulator | 408417-001 | 1 |
| 20 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 45074-406 | 8 |
| 21 | | Screw, BDGH, Phillips, 6-32 x 1/2 | 45074-917 | 2 |
| 22 | | Tape, Foam | 4819-102 | 2 |
| 24 | A3 | Acquisition Processor PCB, 10-Lead, 2-BP, W/NBP | 801040-001 | 1 |

*For your notes*

# 20

# 800 ACQUISITION MODULE
# PN 411068/411025/417123/417124

**General** ........ **20-2**

Safety ........ 20-2

Assembly Configurations ........ 20-2

**Exploded View PN 411068-001C** ........ **20-3**

**Schematic Diagram PN 411068-001C** ........ **20-4**

**Parts List PN 411068-001C** ........ **20-5**

**Exploded View PN 411025-001C** ........ **20-6**

**Schematic Diagram PN 411025-001C** ........ **20-7**

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**Exploded View PN 417123-001B/417124-001B** ........ **20-9**

**Schematic Diagram PN 417123-001B/417124-001B** ........ **20-10**

**Parts List PN 417123-001B/417124-001B** ........ **20-11**

# General

## Safety

Observe the following warning:

**WARNING**
The data acquisition module contains the isolation barrier between the patient and the rest of the module. If the data acquisition module is removed, repaired, or replaced for any reason, the module must undergo the current leakage and hi-pot tests listed in Chapter 5: "Preventive Maintenance" before being used on a patient. These tests verify the integrity of the isolation barrier, and are necessary to ensure continued safe operation. Failure to perform the tests may cause undue equipment failure and possible health hazards.

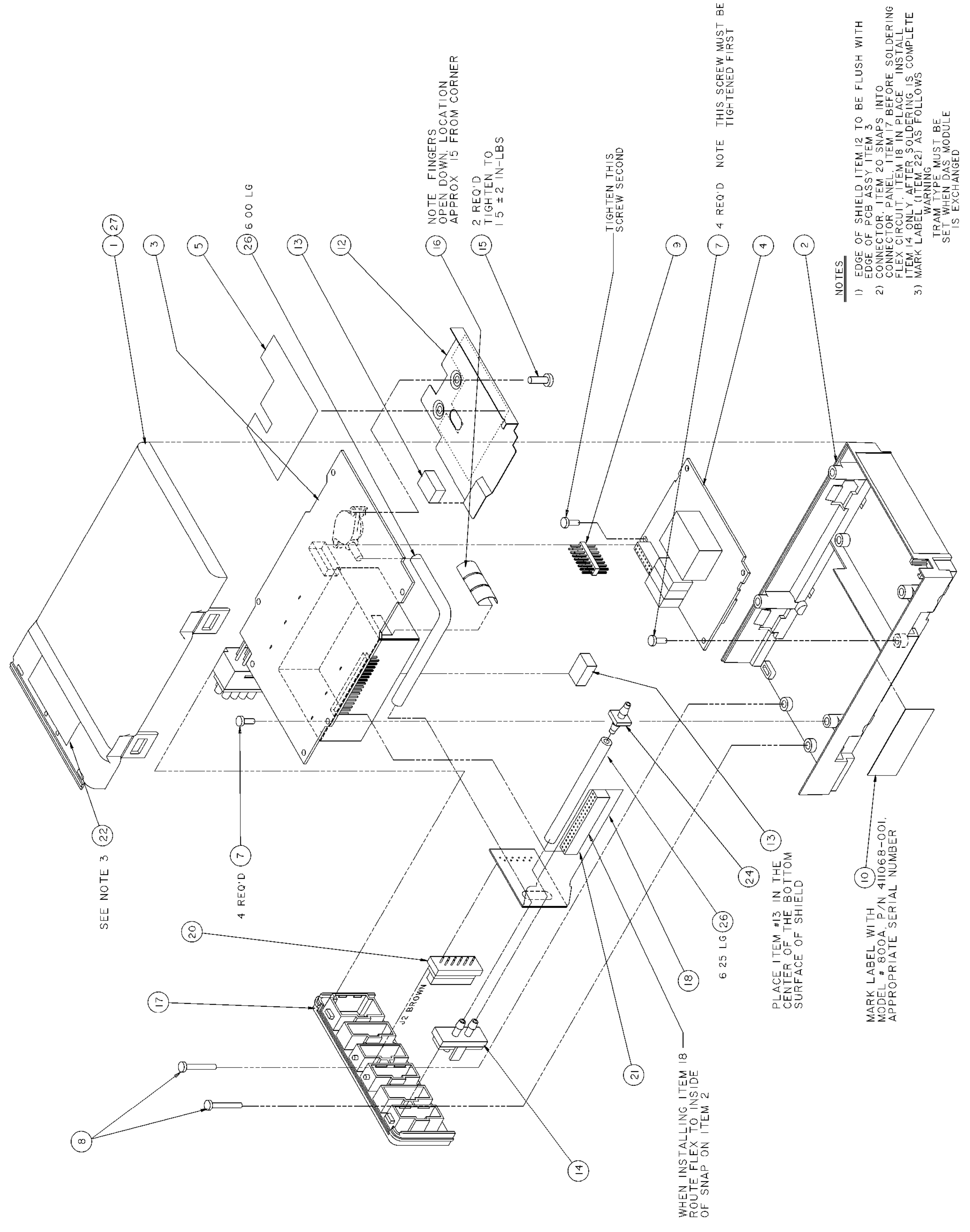
## Assembly Configurations

There are four configurations of the data acquisition module described in this chapter. The difference between the assemblies is in the number of ECG leadwires monitored and the acquisition processor PCB used in the DAS module itself. Use the table below to determine which parts lists to use in this manual for your Tram module.

**Table 20-1. DAS Module Configurations**

| Module Type | Leadwire Configuration | DAS Module | Acquisition Processor PCB |
|---|---|---|---|
| Tram 800A | 5-Leadwire | 411068-001 | 800330-011 |
| Tram 800A | 5-Leadwire | 417124-001 (Replaced 411068-001) | 801040-002 |
| Tram 800SL | 10-Leadwire | 411025-001 | 800330-012 |
| Tram 800SL | 10-Leadwire | 417123-001 (Replaced 411025-001) | 801040-001 |
| Tram 850A | 5-Leadwire | 411068-001 | 800330-011 |
| Tram 850A | 5-Leadwire | 417124-001 (Replaces 411068-001) | 801040-001 |
| Tram 850SL | 10-Leadwire | 411025-001 | 800330-012 |
| Tram 850SL | 10-Leadwire | 417123-001 (Replaces 411025-001) | 801040-001 |

# Exploded View PN 411068-001C



NOTE: FINGERS OPEN DOWN. LOCATION APPROX .15 FROM CORNER

2 REQ'D
TIGHTEN TO 1.5 ± .2 IN-LBS

TIGHTEN THIS SCREW SECOND

4 REQ'D NOTE: THIS SCREW MUST BE TIGHTENED FIRST

NOTES
1) EDGE OF SHIELD ITEM 12 TO BE FLUSH WITH EDGE OF PCB ASSY ITEM 3
2) CONNECTOR, ITEM 20 SNAPS INTO CONNECTOR PANEL, ITEM 17 BEFORE SOLDERING FLEX CIRCUIT. ITEM 18 IN PLACE. INSTALL ITEM 14 ONLY AFTER SOLDERING IS COMPLETE
3) MARK LABEL (ITEM 22) AS FOLLOWS
WARNING
TRAM TYPE MUST BE SET WHEN DAS MODULE IS EXCHANGED

SEE NOTE 3

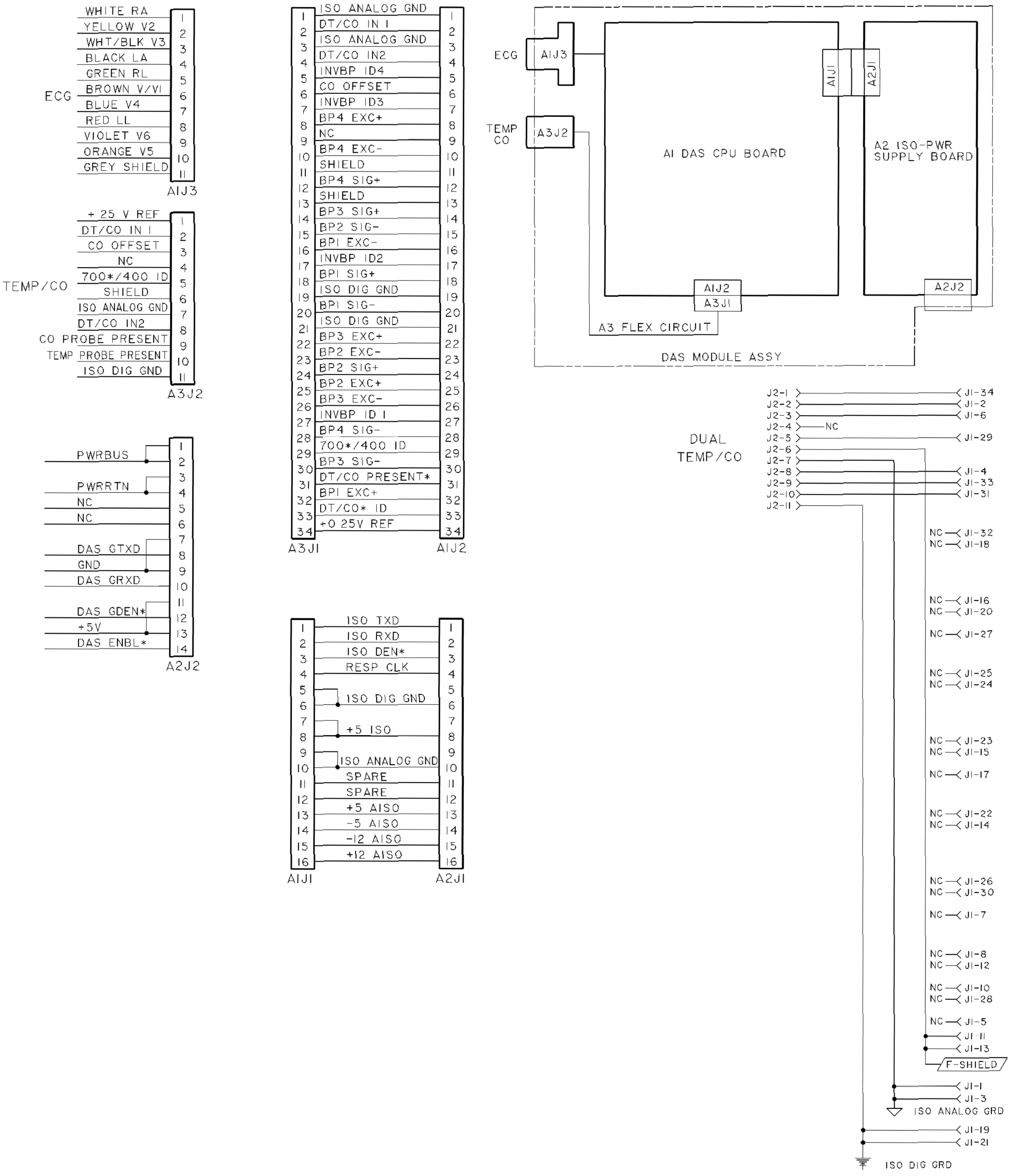
4 REQ'D

WHEN INSTALLING ITEM 18 ROUTE FLEX TO INSIDE OF SNAP ON ITEM 2

PLACE ITEM #13 IN THE CENTER OF THE BOTTOM SURFACE OF THE SHIELD

MARK LABEL WITH MODEL # 800A, P/N 411068-001, APPROPRIATE SERIAL NUMBER

# Schematic Diagram PN 411068-001C


ECG
WHITE RA
YELLOW V2
WHT/BLK V3
BLACK LA
GREEN RL
BROWN V/VI
BLUE V4
RED LL
VIOLET V6
ORANGE V5
GREY SHIELD
A1J3
TEMP/CO
+ 25 V REF
DT/CO IN I
CO OFFSET
NC
700*/400 ID
SHIELD
ISO ANALOG GND
DT/CO IN2
CO PROBE PRESENT
TEMP PROBE PRESENT
ISO DIG GND
A3J2
PWRBUS
PWRRTN
NC
NC
DAS GTXD
GND
DAS GRXD
DAS GDEN*
+5V
DAS ENBL*
A2J2
ISO ANALOG GND
DT/CO IN I
ISO ANALOG GND
DT/CO IN2
INVBP ID4
CO OFFSET
INVBP ID3
BP4 EXC+
NC
BP4 EXC-
SHIELD
BP4 SIG+
SHIELD
BP3 SIG+
BP2 SIG-
BPI EXC-
INVBP ID2
BPI SIG+
ISO DIG GND
BPI SIG-
ISO DIG GND
BP3 EXC+
BP2 EXC-
BP2 SIG+
BP2 EXC+
BP3 EXC-
INVBP ID I
BP4 SIG-
700*/400 ID
BP3 SIG-
DT/CO PRESENT*
BPI EXC+
DT/CO* ID
+0 25V REF
A3J1
A1J2
ISO TXD
ISO RXD
ISO DEN*
RESP CLK
ISO DIG GND
+5 ISO
ISO ANALOG GND
SPARE
SPARE
+5 AISO
-5 AISO
-12 AISO
+12 AISO
A1J1
A2J1
ECG
A1J3
TEMP CO
A3J2
A1J1
A2J1
A1 DAS CPU BOARD
A2 ISO-PWR SUPPLY BOARD
A1J2
A3J1
A2J2
A3 FLEX CIRCUIT
DAS MODULE ASSY
DUAL TEMP/CO
J2-1 J1-34
J2-2 J1-2
J2-3 J1-6
J2-4 NC
J2-5 J1-29
J2-6
J2-7
J2-8 J1-4
J2-9 J1-33
J2-10 J1-31
J2-11
NC J1-32
NC J1-18
NC J1-16
NC J1-20
NC J1-27
NC J1-25
NC J1-24
NC J1-23
NC J1-15
NC J1-17
NC J1-22
NC J1-14
NC J1-26
NC J1-30
NC J1-7
NC J1-8
NC J1-12
NC J1-10
NC J1-28
NC J1-5
J1-11
J1-13
F-SHIELD
J1-1
J1-3
ISO ANALOG GRD
J1-19
J1-21
ISO DIG GRD

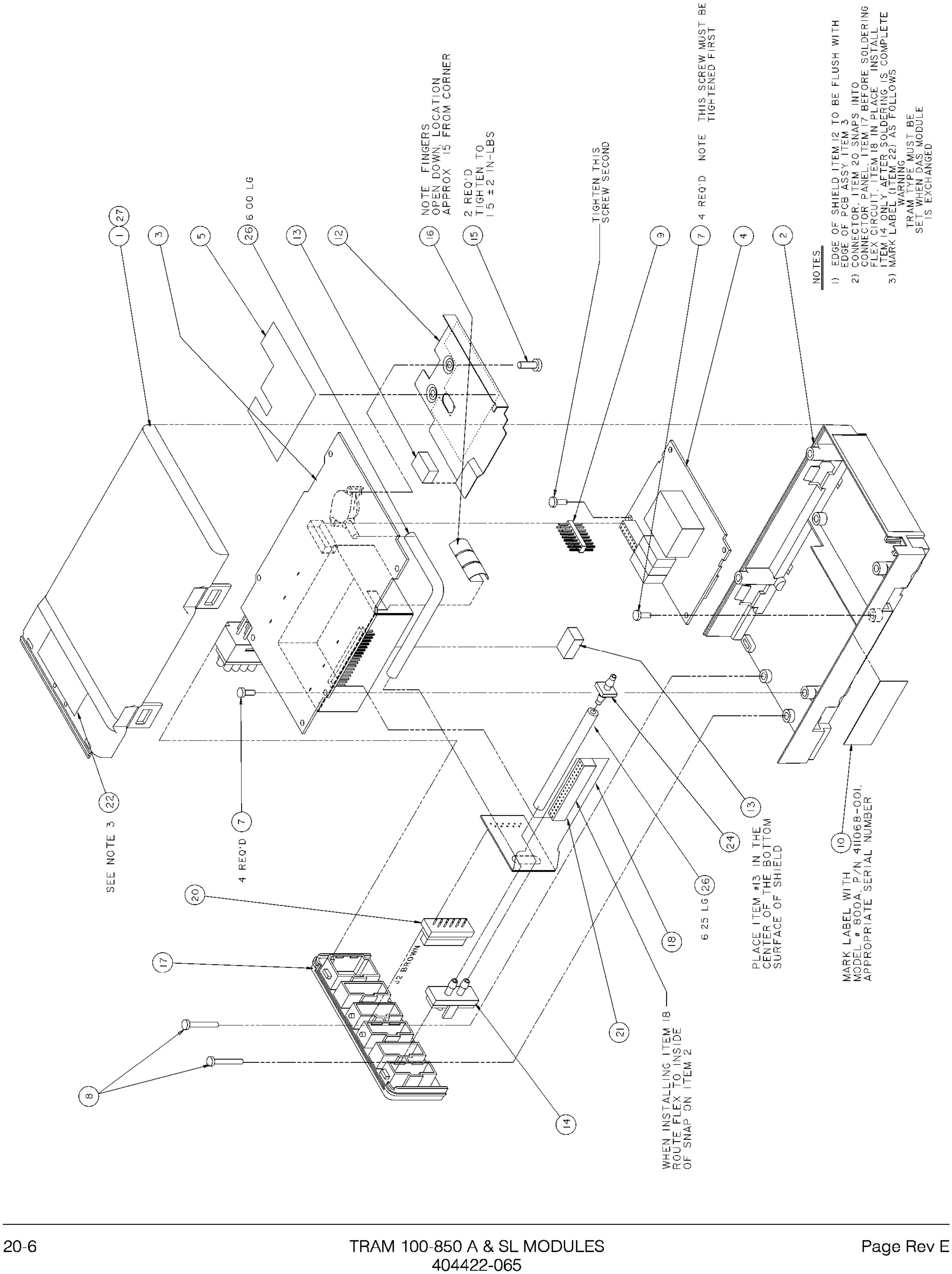
*FLEX CIRCUIT SCHEMATIC*

*ITEM 18*

# Parts List PN 411068-001C

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 1 | | Cover, Top | 401311-001 | 0 |
| 2 | | Cover, Lower | 401681-001 | 0 |
| 3 | A1 | Acquisition Processor PCB, 5-Lead | 800330-011 | 1 |
| 4 | A2 | Isolated Power Supply PCB | 402329-002 | 1 |
| 5 | | Insulator | 408417-001 | 1 |
| 7 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 45074-406 | 8 |
| 8 | | Screw, 4-40 x 7/8 | 404069-001 | 2 |
| 9 | | Header, Vertical, 16-Pin | 1778-916 | 1 |
| 10 | | Label (Marked with “WARNING, TRAM TYPE MUST BE SET WHEN DAS MODULE IS EXCHANGED”) | 404525-001 | 2 |
| 12 | | Shield, Acquisition Processor PCB, Lower | 405517-001 | 1 |
| 13 | | Tape, Foam | 4819-102 | 2 |
| 14 | | Connector, Pneumatic, NBP, Recessed | 414640-002 | 1 |
| 15 | | Screw, BDGH, Phillips, 6-32 x 1/2 | 45074-917 | 2 |
| 16 | | Spring, Chassis Ground, Rear | 403741-001 | AR |
| 17 | | Isolated Connector Panel, Tram 800 | 402159-004 | 1 |
| 18 | A3 | Flex Circuit, Temp | 800397-003 | 1 |
| 20 | | Connector, TEMP/CO (Brown) | 401762-021 | 1 |
| 21 | | Connector, 34-Pin, Horizontal | 17020-034 | 1 |
| 22 | | Label | 404525-001 | 1 |
| 24 | | Connector, Pneumatic | 404445-001 | 1 |
| 26 | | Tubing, Silastic | 401582-001 | AR |

# Exploded View PN 411025-001C

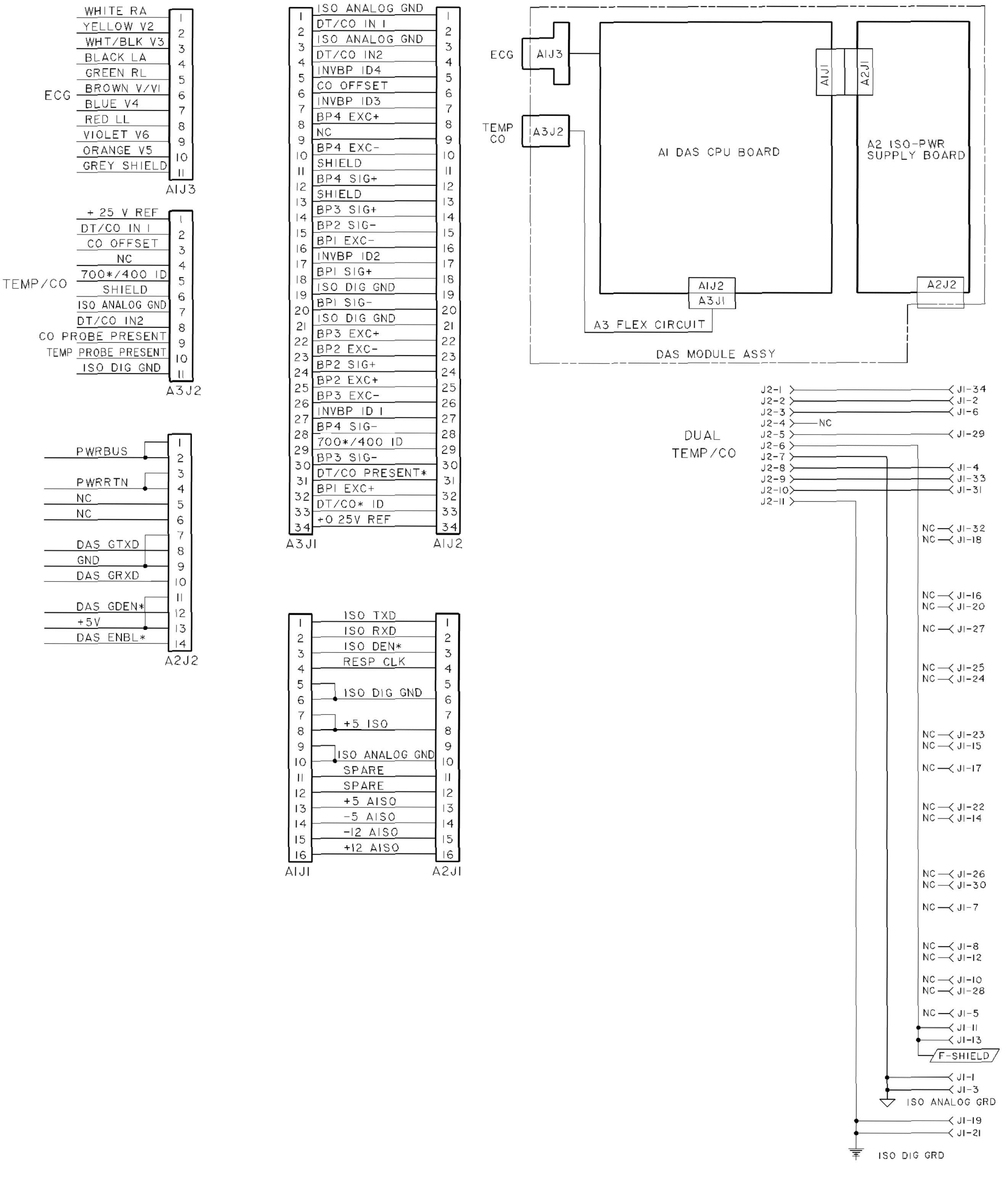

1
27
3
5
26
6 00 LG
13
12
16
NOTE FINGERS OPEN DOWN, LOCATION APPROX 15 FROM CORNER
15
2 REQ'D
TIGHTEN TO 15 ± 2 IN-LBS
TIGHTEN THIS SCREW SECOND
9
7
4 REQ'D NOTE THIS SCREW MUST BE TIGHTENED FIRST
4
2
22
SEE NOTE 3
7
4 REQ'D
20
J2 BROWN
17
8
14
WHEN INSTALLING ITEM 18 ROUTE FLEX TO INSIDE OF SNAP ON ITEM 2
21
18
26
6 25 LG
24
13
PLACE ITEM #13 IN THE CENTER OF THE BOTTOM SURFACE OF THE SHIELD
10
MARK LABEL WITH MODEL # 800A, P/N 411068-001, APPROPRIATE SERIAL NUMBER

NOTES

1) EDGE OF SHIELD ITEM 12 TO BE FLUSH WITH EDGE OF PCB ASSY ITEM 3
2) CONNECTOR, ITEM 20 SNAPS INTO CONNECTOR PANEL, ITEM 17 BEFORE SOLDERING FLEX CIRCUIT, ITEM 18 IN PLACE. INSTALL ITEM 14 ONLY AFTER SOLDERING IS COMPLETE
3) MARK LABEL (ITEM 22) AS FOLLOWS

WARNING
TRAM TYPE MUST BE
SET WHEN DAS MODULE
IS EXCHANGED

# Schematic Diagram PN 411025-001C


ECG
WHITE RA
YELLOW V2
WHT/BLK V3
BLACK LA
GREEN RL
BROWN V/V1
BLUE V4
RED LL
VIOLET V6
ORANGE V5
GREY SHIELD
A1J3
TEMP/CO
+ 25 V REF
DT/CO IN 1
CO OFFSET
NC
700*/400 ID
SHIELD
ISO ANALOG GND
DT/CO IN2
CO PROBE PRESENT
TEMP PROBE PRESENT
ISO DIG GND
A3J2
PWRBUS
PWRRTN
NC
NC
DAS GTXD
GND
DAS GRXD
DAS GDEN*
+5V
DAS ENBL*
A2J2
ISO ANALOG GND
DT/CO IN 1
ISO ANALOG GND
DT/CO IN2
INVBP ID4
CO OFFSET
INVBP ID3
BP4 EXC+
NC
BP4 EXC-
SHIELD
BP4 SIG+
SHIELD
BP3 SIG+
BP2 SIG-
BP1 EXC-
INVBP ID2
BP1 SIG+
ISO DIG GND
BP1 SIG-
ISO DIG GND
BP3 EXC+
BP2 EXC-
BP2 SIG+
BP2 EXC+
BP3 EXC-
INVBP ID 1
BP4 SIG-
700*/400 ID
BP3 SIG-
DT/CO PRESENT*
BP1 EXC+
DT/CO* ID
+0 25V REF
A3J1
A1J2
ISO TXD
ISO RXD
ISO DEN*
RESP CLK
ISO DIG GND
+5 ISO
ISO ANALOG GND
SPARE
SPARE
+5 AISO
-5 AISO
-12 AISO
+12 AISO
A1J1
A2J1
ECG
A1J3
TEMP CO
A3J2
A1J1
A2J1
A1 DAS CPU BOARD
A2 ISO-PWR SUPPLY BOARD
A1J2
A3J1
A2J2
A3 FLEX CIRCUIT
DAS MODULE ASSY
DUAL TEMP/CO
J2-1
J2-2
J2-3
J2-4
J2-5
J2-6
J2-7
J2-8
J2-9
J2-10
J2-11
NC
J1-34
J1-2
J1-6
J1-29
J1-4
J1-33
J1-31
NC J1-32
NC J1-18
NC J1-16
NC J1-20
NC J1-27
NC J1-25
NC J1-24
NC J1-23
NC J1-15
NC J1-17
NC J1-22
NC J1-14
NC J1-26
NC J1-30
NC J1-7
NC J1-8
NC J1-12
NC J1-10
NC J1-28
NC J1-5
J1-11
J1-13
F-SHIELD
J1-1
J1-3
ISO ANALOG GRD
J1-19
J1-21
ISO DIG GRD

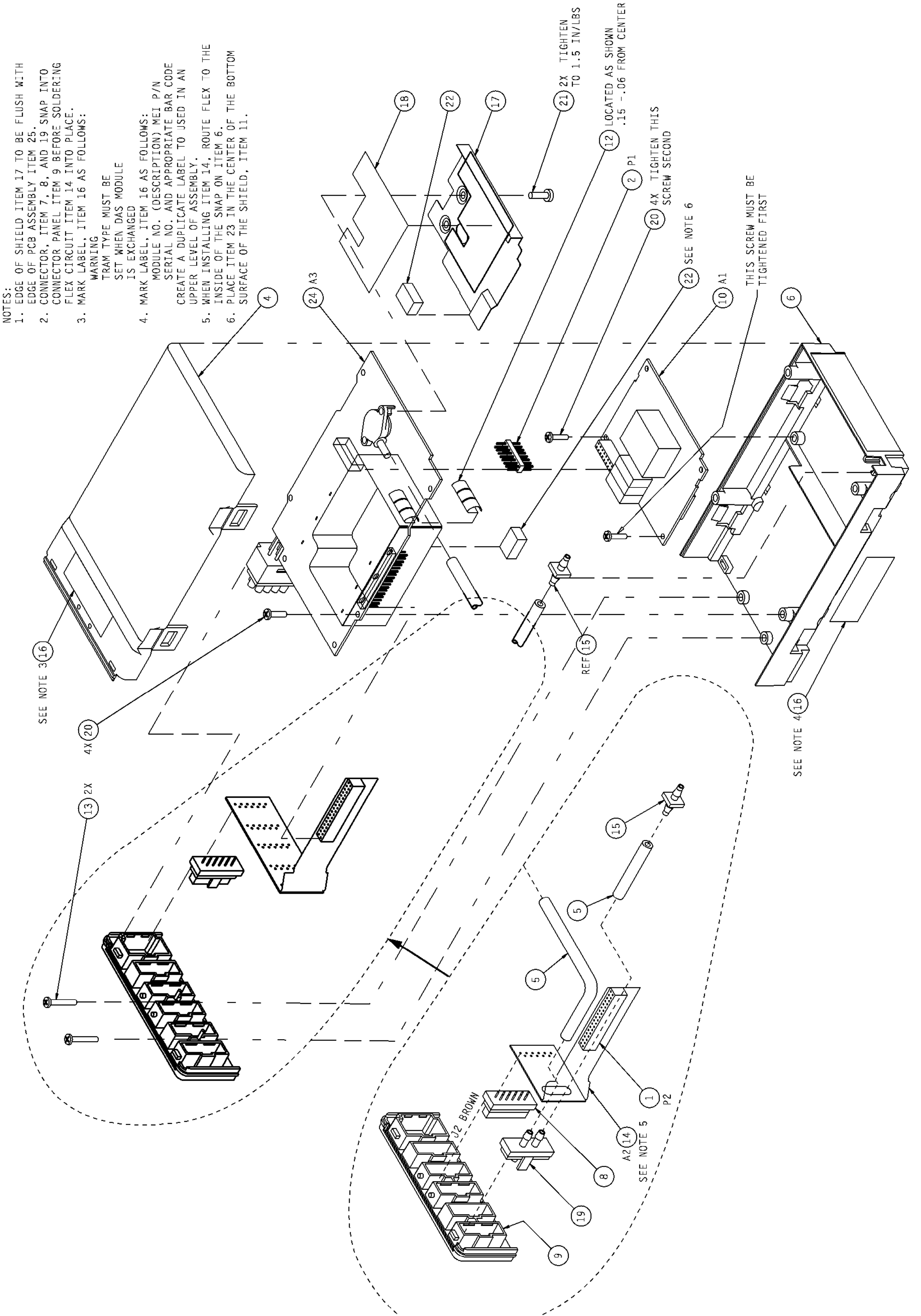
*FLEX CIRCUIT SCHEMATIC*

*ITEM 18*

# Parts List PN 411025-001C

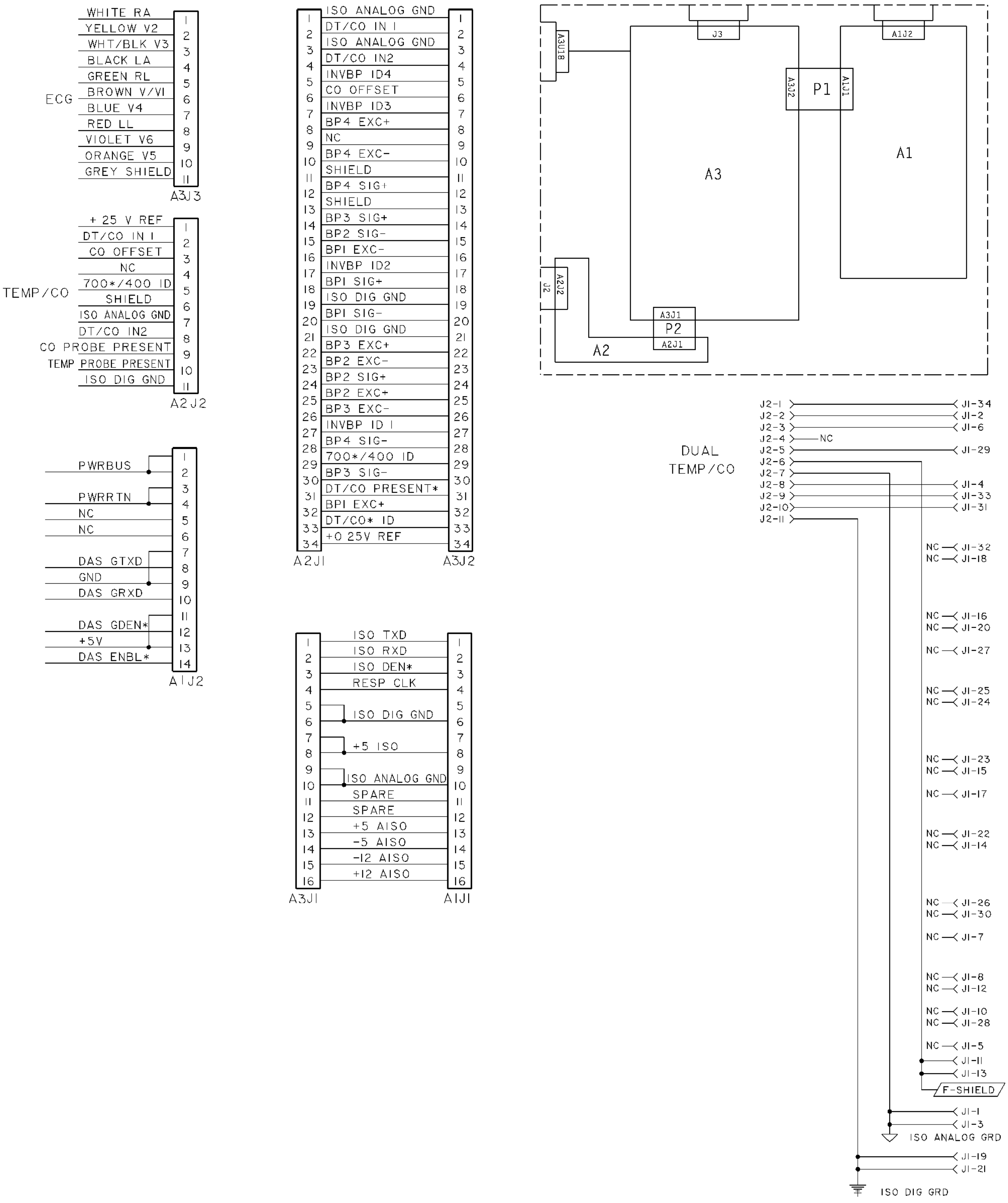
| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 1 | | Cover, Top | 401311-001 | 0 |
| 2 | | Cover, Lower | 401681-001 | 0 |
| 3 | A1 | Acquisition Processor PCB, 10-Lead | 800330-012 | 1 |
| 4 | A2 | Isolated Power Supply PCB | 402329-002 | 1 |
| 5 | | Insulator | 408417-001 | 1 |
| 7 | | Screw, BDGH, Phillips, 4-40 x 3/16 | 45074-406 | 8 |
| 8 | | Screw, 4-40 x 7/8 | 404069-001 | 2 |
| 9 | | Header, Vertical, 16-Pin | 1778-916 | 1 |
| 10 | | Label (Marked with "WARNING, TRAM TYPE MUST BE SET WHEN DAS MODULE IS EXCHANGED") | 404525-001 | 2 |
| 12 | | Shield, Acquisition Processor PCB, Lower | 405517-001 | 1 |
| 13 | | Tape, Foam | 4819-102 | 2 |
| 14 | | Connector, Pneumatic, NBP, Recessed | 414640-002 | 1 |
| 15 | | Screw, BDGH, Phillips, 6-32 x 1/2 | 45074-917 | 2 |
| 16 | | Spring, Chassis Ground, Rear | 403741-001 | 0.1 |
| 17 | | Isolated Connector Panel, Tram 800 | 402159-004 | 1 |
| 18 | A3 | Flex Circuit, Temp | 800397-003 | 1 |
| 20 | | Connector, TEMP/CO (Brown) | 401762-021 | 1 |
| 21 | | Connector, 34-Pin, Horizontal | 17020-034 | 1 |
| 22 | | Label | 404525-001 | 1 |
| 24 | | Connector, Pneumatic | 404445-001 | 1 |
| 26 | | Tubing, Silastic | 401582-001 | AR |

# Exploded View PN 417123-001B/417124-001B


SEE NOTE 3 16
4
4X 20
24 A3
18
22
17
21 2X TIGHTEN TO 1.5 IN/LBS
12 LOCATED AS SHOWN .15 -.06 FROM CENTER
2 P1
20 4X TIGHTEN THIS SCREW SECOND
22 SEE NOTE 6
10 A1
THIS SCREW MUST BE TIGHTENED FIRST
6
SEE NOTE 4 16
REF 15
13 2X
J2 BROWN
9
19
8
A2 14 SEE NOTE 5
1 P2
5
5
15

NOTES:
1. EDGE OF SHIELD ITEM 17 TO BE FLUSH WITH EDGE OF PCB ASSEMBLY ITEM 25.
2. CONNECTOR, ITEM 7, 8, AND 19 SNAP INTO CONNECTOR PANEL ITEM 9 BEFORE SOLDERING FLEX CIRCUIT ITEM 14 INTO PLACE.
3. MARK LABEL, ITEM 16 AS FOLLOWS:
    WARNING
    TRAM TYPE MUST BE
    SET WHEN DAS MODULE
    IS EXCHANGED
4. MARK LABEL, ITEM 16 AS FOLLOWS:
    MODULE NO. (DESCRIPTION) MEI P/N
    SERIAL NO. AND APPROPRIATE BAR CODE
    CREATE A DUPLICATE LABEL TO USED IN AN UPPER LEVEL OF ASSEMBLY.
5. WHEN INSTALLING ITEM 14, ROUTE FLEX TO THE INSIDE OF THE SNAP ON ITEM 6.
6. PLACE ITEM 23 IN THE CENTER OF THE BOTTOM SURFACE OF THE SHIELD, ITEM 11.

# Schematic Diagram PN 417123-001B/417124-001B


ECG
WHITE RA
YELLOW V2
WHT/BLK V3
BLACK LA
GREEN RL
BROWN V/VI
BLUE V4
RED LL
VIOLET V6
ORANGE V5
GREY SHIELD
A3J3
TEMP/CO
+ 25 V REF
DT/CO IN I
CO OFFSET
NC
700*/400 ID
SHIELD
ISO ANALOG GND
DT/CO IN2
CO PROBE PRESENT
TEMP PROBE PRESENT
ISO DIG GND
A2J2
PWRBUS
PWRRTN
NC
NC
DAS GTXD
GND
DAS GRXD
DAS GDEN*
+5V
DAS ENBL*
A1J2
ISO ANALOG GND
DT/CO IN I
ISO ANALOG GND
DT/CO IN2
INVBP ID4
CO OFFSET
INVBP ID3
BP4 EXC+
NC
BP4 EXC-
SHIELD
BP4 SIG+
SHIELD
BP3 SIG+
BP2 SIG-
BP1 EXC-
INVBP ID2
BP1 SIG+
ISO DIG GND
BP1 SIG-
ISO DIG GND
BP3 EXC+
BP2 EXC-
BP2 SIG+
BP2 EXC+
BP3 EXC-
INVBP ID I
BP4 SIG-
700*/400 ID
BP3 SIG-
DT/CO PRESENT*
BP1 EXC+
DT/CO* ID
+0 25V REF
A2J1
A3J2
ISO TXD
ISO RXD
ISO DEN*
RESP CLK
ISO DIG GND
+5 ISO
ISO ANALOG GND
SPARE
SPARE
+5 AISO
-5 AISO
-12 AISO
+12 AISO
A3J1
A1J1
A3U18
J3
A1J2
A3J2
P1
A1J1
A1
A3
J2
A2J2
A3J1
P2
A2J1
A2
DUAL TEMP/CO
J2-1 J1-34
J2-2 J1-2
J2-3 J1-6
J2-4 NC
J2-5 J1-29
J2-6
J2-7
J2-8 J1-4
J2-9 J1-33
J2-10 J1-31
J2-11
NC J1-32
NC J1-18
NC J1-16
NC J1-20
NC J1-27
NC J1-25
NC J1-24
NC J1-23
NC J1-15
NC J1-17
NC J1-22
NC J1-14
NC J1-26
NC J1-30
NC J1-7
NC J1-8
NC J1-12
NC J1-10
NC J1-28
NC J1-5
J1-11
J1-13
F-SHIELD
J1-1
J1-3
ISO ANALOG GRD
J1-19
J1-21
ISO DIG GRD

FLEX CIRCUIT SCHEMATIC

# Parts List PN 417123-001B/417124-001B

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 1 | P2 | Connector, 34-Pin, Horizontal | 17020-034 | 1 |
| 2 | P1 | Header, Vertical, 16-Pin | 1778-916 | 1 |
| 4 |  | Cover, Top | 401311-001 | 1 |
| 5 |  | Tubing, Silastic | 401582-001 | AR |
| 6 |  | Cover, Lower | 401681-001 | 1 |
| 7 |  | Connector, BP (Red) | 401762-004 | 2 |
| 8 |  | Connector, TEMP/CO (Brown) | 401762-021 | 1 |
| 9 |  | Isolated Connector Panel, Tram 800 | 402159-004 | 1 |
| 10 | A1 | Isolated Power Supply PCB | 402329-002 | 1 |
| 12 |  | Spring, Chassis Ground, Rear | 403741-001 | AR |
| 13 |  | Screw, 4-40 x 7/8 | 404069-001 | 2 |
| 14 | A2 | Flex Circuit, BP/Temp | 800397-003 | 1 |
| 15 |  | Connector, Pneumatic | 404445-001 | 1 |
| 16 |  | Label (Marked with "WARNING, TRAM TYPE MUST BE SET WHEN DAS MODULE IS EXCHANGED") | 404525-001 | 2 |
| 17 |  | Shield, Acquisition Processor PCB, Lower | 405517-001 | 1 |
| 18 |  | Insulator | 408417-001 | 1 |
| 19 |  | Socket, NBP w/o Key | 414640-002 | 1 |
| 20 |  | Screw, BDGH, Phillips, 4-40 x 3/16 | 45074-406 | 8 |
| 21 |  | Screw, BDGH, Phillips, 6-32 x 1/2 | 45074-917 | 2 |
| 22 |  | Tape, Foam | 4819-102 | 2 |
| 24 | A3 | Acquisition Processor PCB, 5-Lead, 2-BP, W/NBP (For 417124-001 Only) | 801040-001 | 1 |
| 24 | A3 | Acquisition Processor PCB, 10-Lead, 2-BP, W/NBP (For 417123-001 Only) | 801040-002 | 1 |

*For your notes*

# 21 NBP VALVE ASSEMBLY PN 416153

**General** .......................................................................... 21-2

**Exploded View PN 416153-001A** ....................................................... 21-3

**Exploded View PN 413021-001B/404459-001C** ................................ 21-4

**Parts List PN 413021-001B/404459-001C** ....................................... 21-5

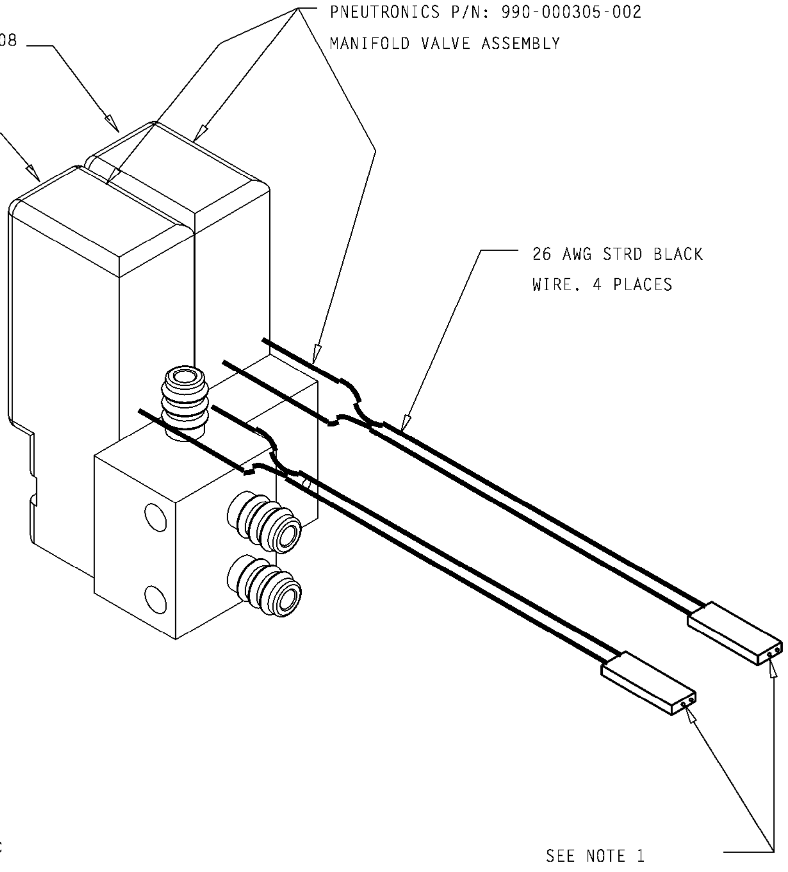
# General

This chapter describes the NBP valve assembly used in the Tram 100A, 200A/SL, 250SL,400A/SL, 450SL, 800A/SL, and 850A/SL modules. A parts list and an exploded view are presented in this chapter.

The NBP valve assembly contains the pressure release valves that regulate the air pressure in the noninvasive blood pressure cuff. Because it is manufactured by a vendor, no parts lists is provided.

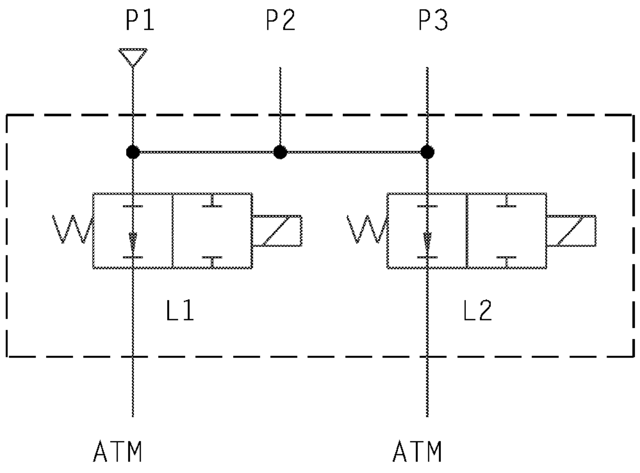
Older assemblies pn 413021-001 and pn 404459-001 are included in this chapter for reference only, but they should be replaced with the pn 416153-001 version if the assembly proves defective.

# Exploded View PN 416153-001A


PNEUTRONICS P/N: 990-000300-008
.030 ORFICE, 25 PSI (L1)
PNEUTRONICS P/N: 990-000300-007
.060 ORFICE, 6 PSI (L2)
PNEUTRONICS P/N: 990-000305-002
MANIFOLD VALVE ASSEMBLY
26 AWG STRD BLACK
WIRE, 4 PLACES
SEE NOTE 1

NOTES:

1. CONNECTOR HOUSING IS AN AMP P/N: 87499-3
   OR 87499-4.
   CONTACT IS AN AMP P/N: 530151-7
   (MEI P/N: 1779-003).
2. VENDOR INFORMATION: PNEUTRONICS
   P/N: 990-000305-002
3. TEST MANIFOLD VALVE ASSEMBLY FOR MAXIMUM
   LEAKAGE OF 0.5 mmHg/MIN. ALL TESTING TO BE
   DONE AT 9.6VDC MAX. AT ROOM TEMPERATURE.
   ALL PRESSURES CONDUCTED AT 6.6 PSIG MAXIMUM.
   475-525 MILLILITER VOLUME PRESSURIZED TO
   238-262 mmHg.
4. ELECTRICAL SPECIFICATIONS: 12VDC NOMINAL, 9.6VDC
   MINIMUM, 0.50-0.56W, 257-288 OHM.
5. TEST FLOW RATE ON VALVE AUTOMATIC TESTER
   (MEI MT4500) VALVE PRESSURE DROP (mmHg):
   L1 = 75-104
   L2 = 40-77
   475-525 MILLILITER VOLUME PRESSURIZED TO
   200 -2 mmHg.
6. PACKAGING SHALL BE CLEAN AND FREE OF LOOSE
   PARTICLES. PACKAGE ASSEMBLIES IN CLOSED
   ANTISTATIC BAGS TO PREVENT CONTAMINATION.
7. OPERATING TEMPERATURE RANGE: 0i TO 70iC.
8. ANY CHANGES TO THIS ASSEMBLY AND/OR
   VALVES MUST HAVE WRITTEN APPROVAL FROM
   MEI ENGINEERING.
9. LABEL THE MANIFOLD VALVE ASSEMBLY WITH:
   P/N 990-000305-002 AND DATE CODE.
   LABEL EACH VALVE WITH PNEUTRONICS PART
   NUMBER AND 9.6VDC.

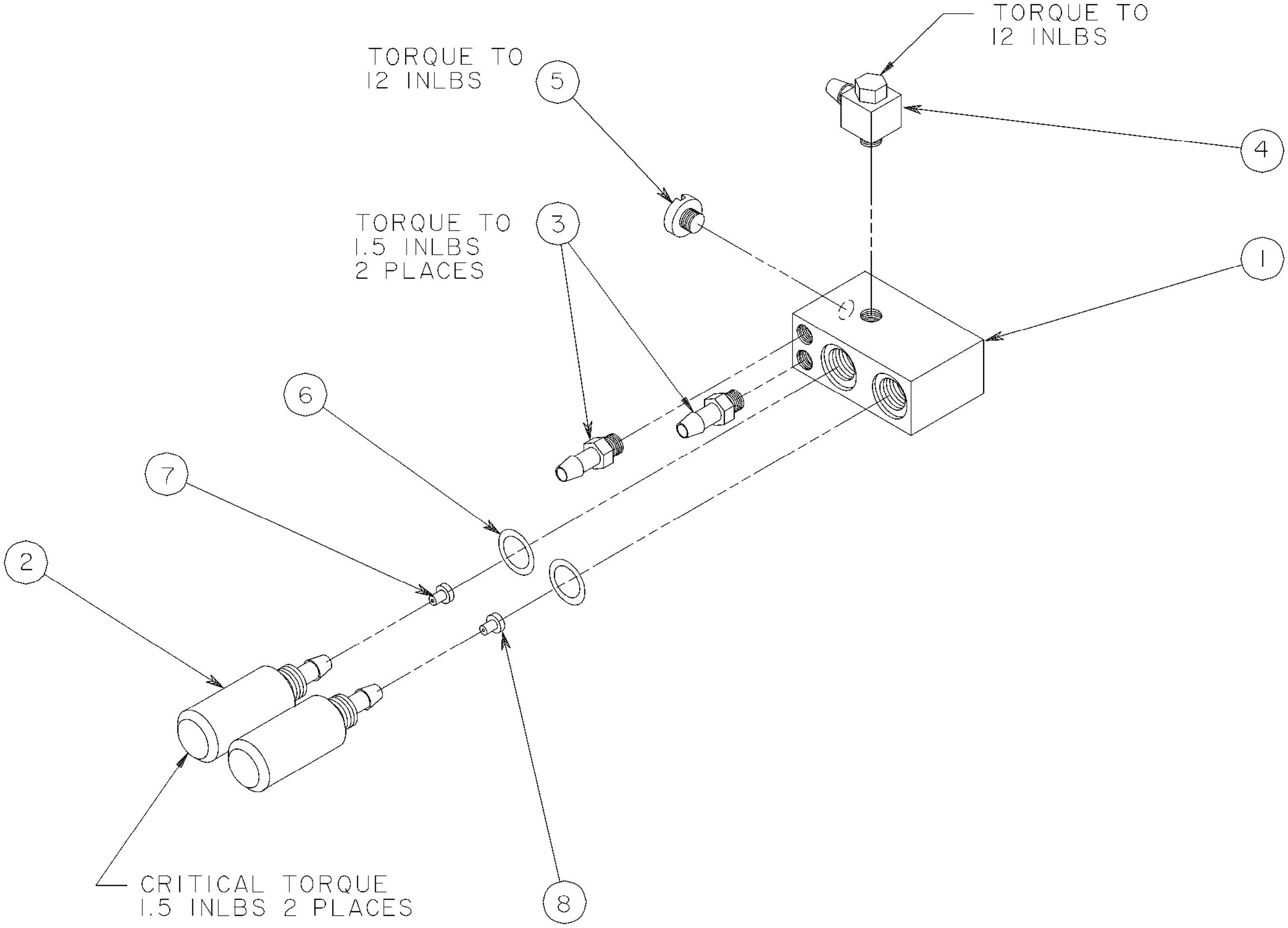

P1
P2
P3
L1
L2
ATM
ATM

PNEUMATIC SCHEMATIC

ATM ATM

PNEUMATIC SCHEMATIC

# Exploded View PN 413021-001B/404459-001C


TORQUE TO
12 INLBS
TORQUE TO
12 INLBS
5
4
TORQUE TO
1.5 INLBS
2 PLACES
3
1
6
7
2
CRITICAL TORQUE
1.5 INLBS 2 PLACES
8

# Parts List PN 413021-001B/404459-001C

| Item | Reference Designation | Parts List | Part Number | Qty |
|---|---|---|---|---|
| 1 | | Manifold, NBP | 404523-001 | 1 |
| 2 | V0, V1, W4, W5 | Valve, Solenoid -- w/Harness (For PN 413021-001 Only) | 413024-001 | 2 |
| 2 | V0, V1, W4, W5 | Valve, Solenoid -- w/Harness (For PN 404459-001 Only) | 700040-001 | 2 |
| 3 | | Fitting, Adapter, 10-32 to 1/8-Inch ID | 4745-201 | 2 |
| 4 | | Fitting, Adapter, 90˚, 10-32 to 1/8-Inch ID | 404635-001 | 1 |
| 5 | | Plug, Brass, 10-32 | 404674-001 | 1 |
| 6 | | O-Ring, 0.301-Inch ID | 404740-002 | 2 |
| 7 | | Restrictor, 0.06/0.063 (Black) | 404637-002 | 1 |
| 8 | | Restrictor, 0.03/0.033 (White) | 404637-001 | 1 |
| 9 | | Sealant, Loctite 92 | 4851-048 | AR |

*For your notes*

# 22

# POWER SUPPLY ASSEMBLY PN 401309

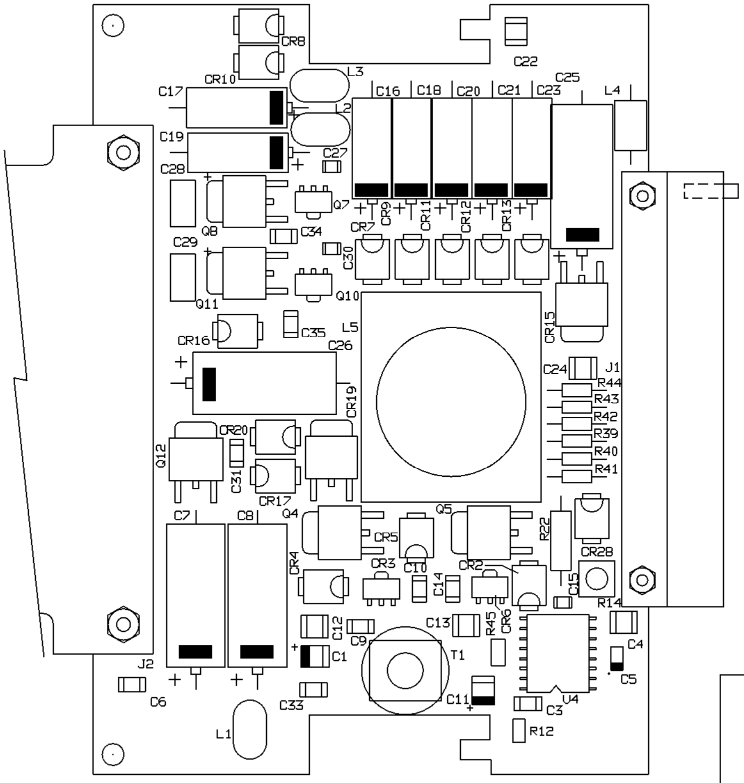
**Location Diagram PN 401309-002J** ........................................22-2

**Parts List PN 401309-002J** ........................................22-3

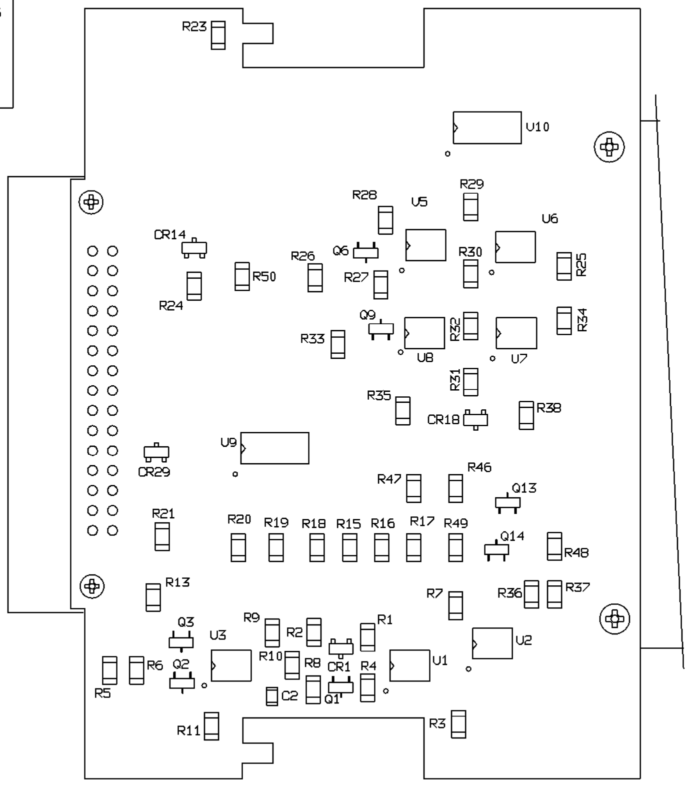
**Schematic Diagram PN 401309-001F** ........................................22-5

# Parts Location Diagram PN 401309-002J

Component Side


CR8
CR10
L3
C17
L2
C19
C27
C28
C16
C18
C20
C21
C23
C22
C25
L4
Q8
Q7
C34
CR7
CR9
CR11
CR12
CR13
C29
C30
Q10
Q11
C35
L5
CR16
C26
CR19
CR15
C24
J1
R44
R43
R42
R39
R40
R41
Q12
CR20
C31
CR17
C7
C8
Q4
Q5
CR5
CR4
CR3
C10
CR2
R22
CR28
C14
C15
R14
C12
C13
R45
CR6
C4
C9
C1
T1
C5
J2
C6
C33
C11
C3
U4
L1
R12

Solder Side


R23
U10
R28
R29
U5
U6
CR14
R26
Q6
R30
R25
R50
R27
R24
Q9
R32
R34
R33
U8
U7
R31
R35
CR18
R38
U9
CR29
R47
R46
Q13
R21
R20
R19
R18
R15
R16
R17
R49
Q14
R48
R13
R7
R36
R37
R9
R1
Q3
U3
R2
U2
R6
Q2
R10
R8
CR1
R4
U1
R5
C2
Q1
R11
R3

# Parts List PN 401309-002J

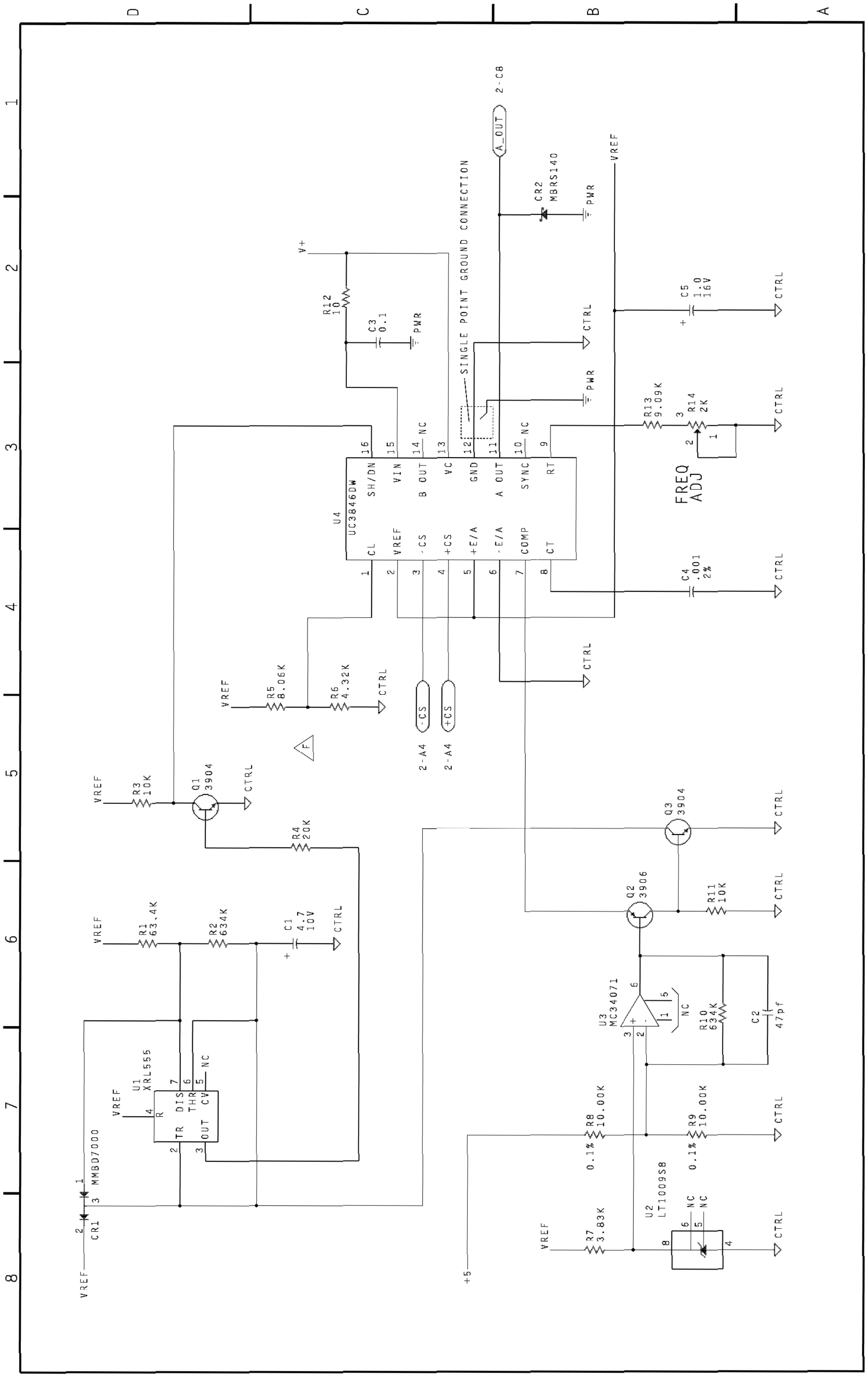
| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| C1, 11 | Cap, Tant, 4.7µF, 20%, 10V, SM | 1176-475 | 2 |
| C2 | Cap, Cer, 47pF, 5%, 50V, SM | 1181-470 | 1 |
| C3, 6, 9, 10, 14, 31, 33, 34, 35 | Cap, Cer, 0.1µF, 20%, 50V | 404370-001 | 9 |
| C4 | Cap, Cer, 1000pF, 2%, SM | 1184-102 | 1 |
| C5 | Cap, Tant, 1µF, 10%, 16V, SM | 403253-001 | 1 |
| C7, 8 | Cap, Tant, 47µF, 10%, 20V | 1127-476 | 2 |
| C12, 13 | Cap, Cer, 0.0022µF, 5%, 100V, SM | 403030-001 | 2 |
| C15 | Cap, Cer, 0.001µF, 5%, 50V, SM | 1181-102 | 1 |
| C16 - 19, 23 | Cap, Tant, 27µF, 10%, 20V | 1135-276 | 5 |
| C20, 21 | Cap, Tant, 82µF, 10%, 10V | 1225-826 | 2 |
| C22, 24 | Cap, Cer, 0.01µF, 10%, 100V, SM | 403029-001 | 2 |
| C25, 26 | Cap, Tant, 120µF, 10%, 35V | 1124-127 | 2 |
| C27, 30 | Cap, Cer, 470pF, 5%, 50V, SM | 1181-471 | 2 |
| C28, 29 | Cap, Tant, 10µF, 20%, 10V, SM | 1176-106 | 2 |
| CR1, 18 | Diode Pair, Series, SM D7000 | 2013-201 | 2 |
| CR14 | Diode, Zener, 16.8V, SM | 403937-001 | 1 |
| CR15, 19 | Diode, Schottky, SM MBRD340 | 403929-001 | 2 |
| CR16, 28 | Transient Voltage Suppressor P6SMB6.8AT1 | 403189-001 | 2 |
| CR2, 4, 5, 11, 12 | Diode, Schottky, Barrier, 1A, 40V, SM MBRS140T3 | 403187-001 | 5 |
| CR29 | Diode, Schottky, SM BAT54 | 401985-001 | 1 |
| CR3, 6 | Diode, Zener, SM BZV49C18 | 403007-001 | 2 |
| CR7, 9, 13 | Diode, Rectifier, 1A, 100V, SM MURS110T3 | 403190-001 | 3 |
| CR8, 10 | Transorb, 15V, 5%, 600W SM6T15A | 403188-001 | 2 |
| J1 | Connector, PC Header, 30-Pin | 1865-030 | 1 |
| J2 | Flex Circuit Assembly, Power Supply | 404150-001 | 1 |
| L1, 2, 3 | Inductor, Bead | 1426-001 | 3 |
| L4 | Ferrite Bead | 403921-001 | 1 |
| L5 | Inductor, Coupled | 404256-001 | 1 |
| Q1, 3, 13, 14 | Transistor, NPN, SM T3904 | 2511-001 | 4 |
| Q2, 6, 9 | Transistor, PNP, SM T3906 | 2511-101 | 3 |
| Q4, 5 | Transistor, MOSFET, N-Channel, SM IRFR024 | 403047-001 | 2 |
| Q7 | Transistor, NPN, SM BCX56-1 | 2712-056 | 1 |
| Q8 | Transistor, PNP, SM MJD2955 | 403930-001 | 1 |
| Q10 | Transistor, PNP, SM BCX53-10 | 2712-053 | 1 |
| Q11 | Transistor, NPN, SM MJD3055 | 403931-001 | 1 |
| Q12 | Transistor, MOSFET, P-Channel, SM IRFR9024 | 403274-001 | 1 |
| R1 | Res, Cer, 63.4K, 1%, 1/8W, SM | 1082-808 | 1 |
| R2, 10 | Res, Cer, 634K, 1%, 1/8W, SM | 1082-809 | 2 |
| R3 , 11, 46 - 49 | Res, Cer, 10K, 1%, 1/8W, SM | 1082-104 | 6 |
| R4 | Res, Cer, 20K, 1%, 1/8W, SM | 1082-202 | 1 |

| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| R5 | Res, Cer, 8.06K, 10%, 1/4W, SM | 1082-920 | 1 |
| R6 | Res, Cer, 4.32K, 1%, 1/8W, SM | 1082-876 | 1 |
| R7, 25, 34 | Res, Cer, 3.83K, 1%, 1/8W, SM | 1082-810 | 3 |
| R8, 9, 29 - 32 | Res, Cer, 10K, 0.1%, 1/8W, SM | 1067-834 | 6 |
| R12, 23, 45 | Res, Cer, 10Ω, 1%, 1/8W, SM | 1082-786 | 3 |
| R13 | Res, Cer, 9.09K, 1%, 1/8W, SM | 1082-814 | 1 |
| R14 | Res, Var, 2K, Top Adjust | 403938-001 | 1 |
| R15, 19 | Res, Cer, 22Ω, 5%, 1/8W, SM | 1081-220 | 2 |
| R16, 20 | Res, Cer, 2.21K, 1%, 1/8W, SM | 1082-787 | 2 |
| R17, 18 | Res, Cer, 3.3Ω, 10%, 1/4W, SM | 403026-001 | 2 |
| R21 | Res, Cer, 240Ω, 5%, 1/8W, SM | 1081-471 | 1 |
| R22 | Res, WW, 0.1Ω, 5%, 1/2W | 1017-003 | 1 |
| R24 | Res, Cer, 43Ω, 10%, 1/4W, SM | 403025-001 | 1 |
| R26 | Res, 340Ω, 1%, 1/8W, SM | 1082-790 | 1 |
| R27, 35, 38 | Res, Cer, 1K, 1%, 1/8W, SM | 1082-103 | 3 |
| R28, 33 | Res, Cer, 15Ω, 1%, 1/8W, SM | 1082-811 | 2 |
| R36 | Res, Cer, 5.11K, 1%, 1/8W, SM | 1082-784 | 1 |
| R37 | Res, Cer, 100K, 1%, 1/8W, SM | 1082-100 | 1 |
| R39 - 44 | Res, Comp, 100Ω, 5%, 1/8W | 1000-101 | 6 |
| R50 | Res, Cer, 6.65K, 1%, 1/8W, SM | 1082-850 | 1 |
| T1 | Transformer, SM | 403106-001 | 1 |
| U1 | Timer, SM XR-L555 | 403927-001 | 1 |
| U2, 6, 7 | Diode, Regulator, SM LT1009S8 | 403928-001 | 3 |
| U3, 5, 8 | Operational Ampl, Single Supply, SM MC34071 | 403926-001 | 3 |
| U4 | Pulse Width Modulator, SM UC3846 | 402990-001 | 1 |
| U9, 10 | Diode Array, SM MMAD130 | 403957-001 | 2 |
| - | Adhesive, Permalok | 4851-079 | AR |
| - | Key, Polarizing (for J1) | 1865-999 | 1 |
| - | Heat Shrink Tubing (for L1, 2, 3) | 404747-001 | AR |
| - | Screw, PNH, Phillips, SST, 2-56 x 11/32 (for J1) | 4502-211 | 2 |
| - | Screw, PNH, Phillips, SST, 4-40 x 3/8 (for J2) | 4502-412 | 2 |
| - | Nut, Hex, 2-56 (for J1) | 4521-102 | 2 |
| - | Nut, Hex, 4-40 (for J2) | 4521-304 | 2 |
| - | Washer, Nylon, No 4 (for J2) | 4550-013 | 2 |
| - | Circuit Board | 401309-001E | 1 |
| - | Schematic Diagram | 401309-003F | REF |

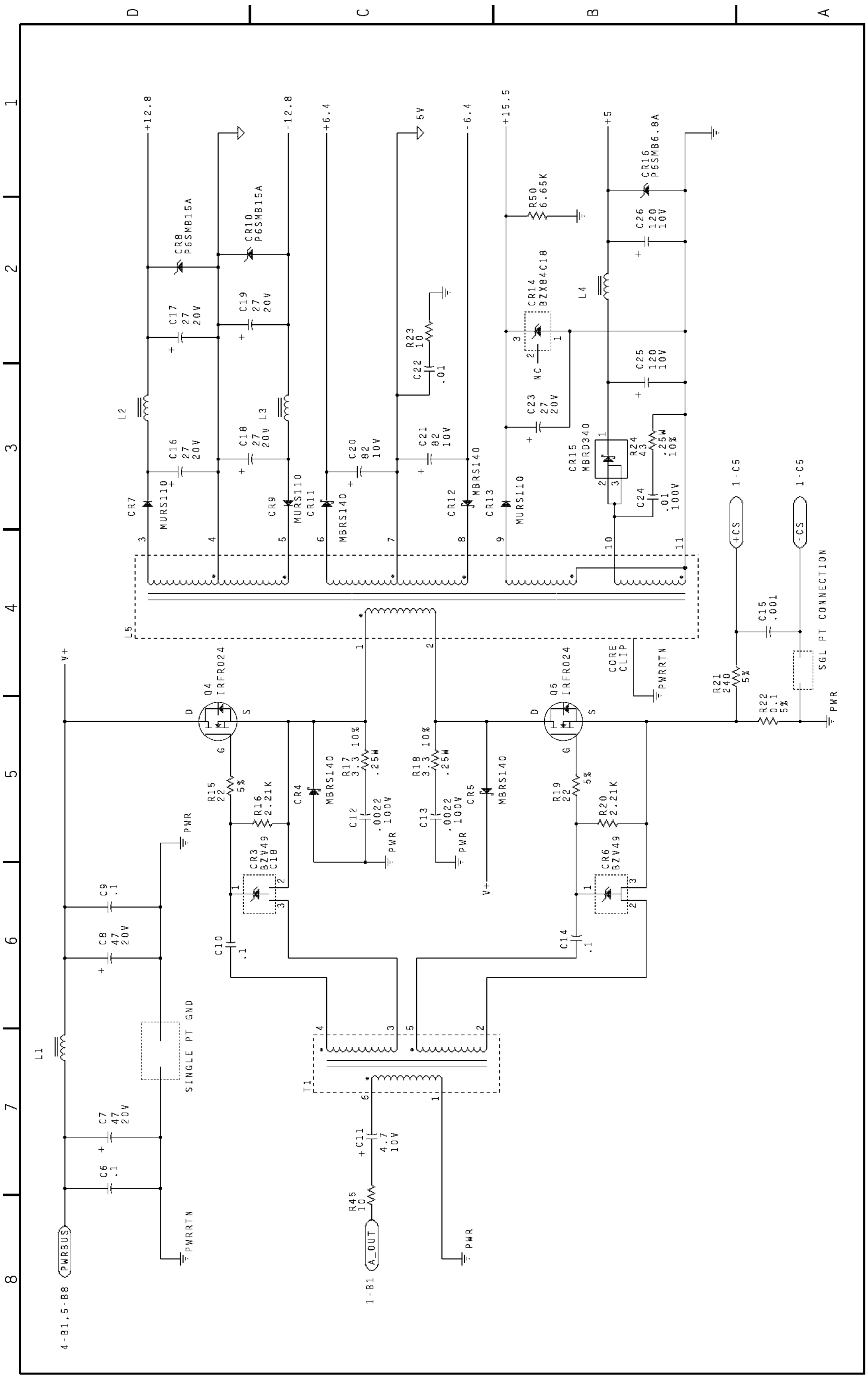
# Schematic Diagram

# PN 401309-001F

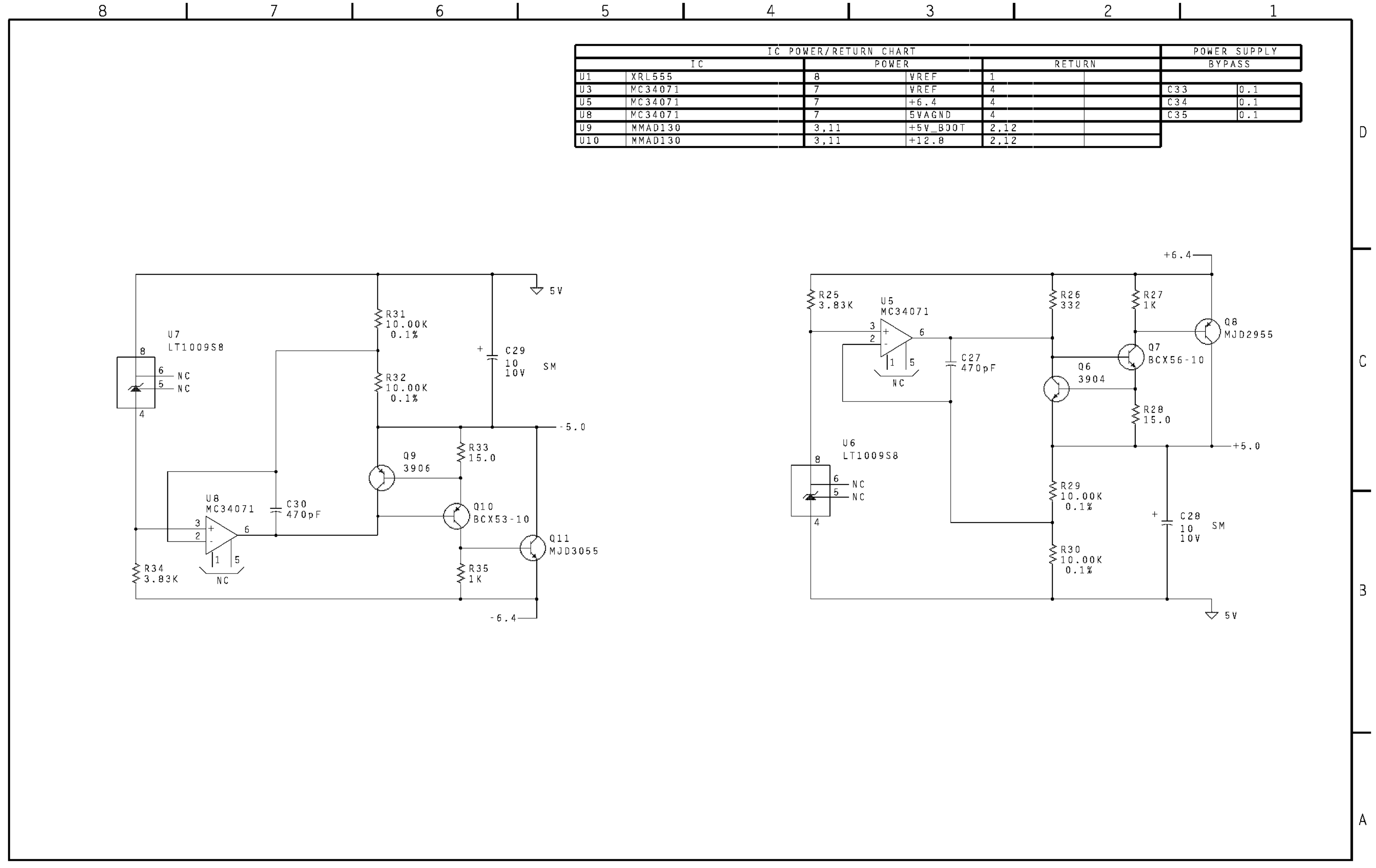
1 of 5


D
C
B
A
1
2
3
4
5
6
7
8
U4
UC3846DW
SH/DN
VIN
B OUT
VC
GND
A OUT
SYNC
RT
CL
VREF
-CS
+CS
+E/A
-E/A
COMP
CT
SINGLE POINT GROUND CONNECTION
A_OUT
2-C8
CR2
MBRS140
PWR
VREF
V+
R12
10
C3
0.1
CTRL
C5
1.0
16V
R13
9.09K
R14
2K
FREQ
ADJ
C4
.001
2%
NC
R5
8.06K
R6
4.32K
-CS
+CS
2-A4
F
R3
10K
Q1
3904
R4
20K
Q3
3904
Q2
3906
R11
10K
R1
63.4K
R2
634K
C1
4.7
10V
U3
MC34071
R10
634K
C2
47pf
U1
XRL555
DIS
THR
CV
TR
OUT
R
MMBD7000
CR1
R8
10.00K
0.1%
R9
10.00K
U2
LT1009S8
R7
3.83K
+5

2 of 5


D
C
B
A
1
2
3
4
5
6
7
8
+12.8
-12.8
+6.4
5V
-6.4
+15.5
+5
CR8
P6SMB15A
CR10
P6SMB15A
C17
27
20V
C19
27
20V
L2
L3
C16
27
20V
C18
27
20V
CR7
MURS110
CR9
MURS110
CR11
MBRS140
C20
82
10V
C21
82
10V
R23
10
C22
.01
CR12
MBRS140
CR13
MURS110
R50
6.65K
CR14
BZX84C18
NC
C23
27
20V
CR15
MBRD340
R24
43
.25W
10%
C24
.01
100V
CR16
P6SMB6.8A
C26
120
10V
L4
C25
120
10V
1-C5
+CS
-CS
SGL PT CONNECTION
C15
.001
L5
CORE CLIP
PWRRTN
R21
240
5%
R22
0.1
5%
PWR
V+
Q4
IRFR024
Q5
IRFR024
D
G
S
R15
22
5%
R16
2.21K
CR4
MBRS140
R17
3.3 10%
.25W
C12
.0022
100V
R18
3.3 10%
.25W
C13
.0022
100V
CR5
MBRS140
R19
22
5%
R20
2.21K
CR3
BZV49
C18
CR6
BZV49
C10
.1
C14
.1
C9
.1
C8
47
20V
L1
SINGLE PT GND
C7
47
20V
C6
.1
PWRRTN
T1
C11
4.7
10V
R45
10
A_OUT
1-B1
PWRBUS
4-B1.5-B8

3 of 5


8
7
6
5
4
3
2
1
D
C
B
A
+6.4
R27
1K
R26
332
R25
3.83K
U5
MC34071
3
2
6
1
5
NC
C27
470pF
Q8
MJD2955
Q7
BCX56-10
Q6
3904
R28
15.0
+5.0
U6
LT1009S8
8
6
5
NC
NC
4
R29
10.00K
0.1%
C28
10
10V
SM
R30
10.00K
0.1%
5V
R31
10.00K
0.1%
U7
LT1009S8
R32
10.00K
0.1%
C29
10
10V
SM
-5.0
Q9
3906
R33
15.0
U8
MC34071
C30
470pF
Q10
BCX53-10
Q11
MJD3055
R34
3.83K
R35
1K
-6.4

| IC POWER/RETURN CHART | | | | | POWER SUPPLY | |
|---|---|---|---|---|---|---|
| IC | | POWER | | RETURN | BYPASS | |
| U1 | XRL555 | 8 | VREF | 1 | | |
| U3 | MC34071 | 7 | VREF | 4 | C33 | 0.1 |
| U5 | MC34071 | 7 | +6.4 | 4 | C34 | 0.1 |
| U8 | MC34071 | 7 | 5VAGND | 4 | C35 | 0.1 |
| U9 | MMAD130 | 3,11 | +5V_BOOT | 2,12 | | |
| U10 | MMAD130 | 3,11 | +12.8 | 2,12 | | |

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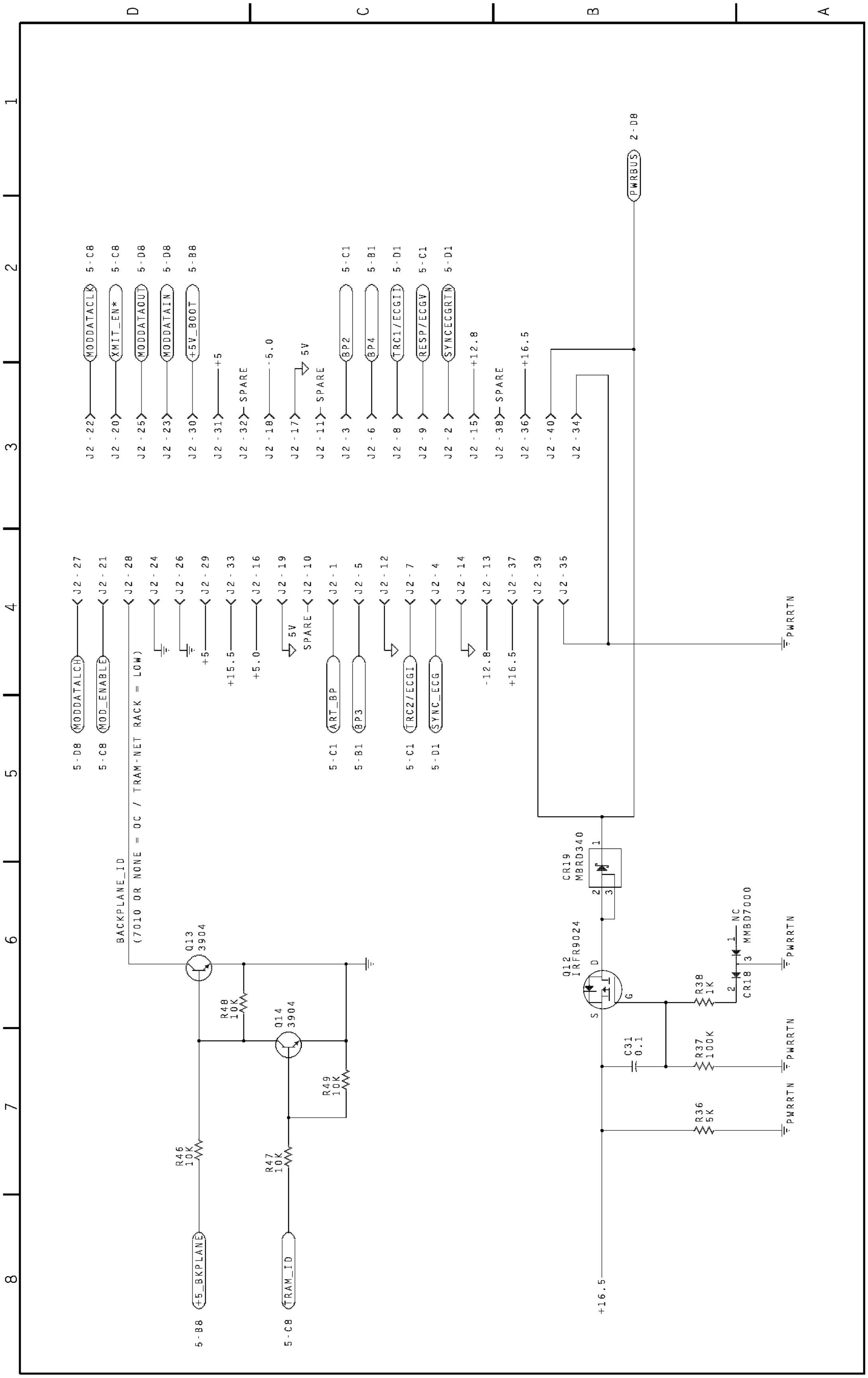
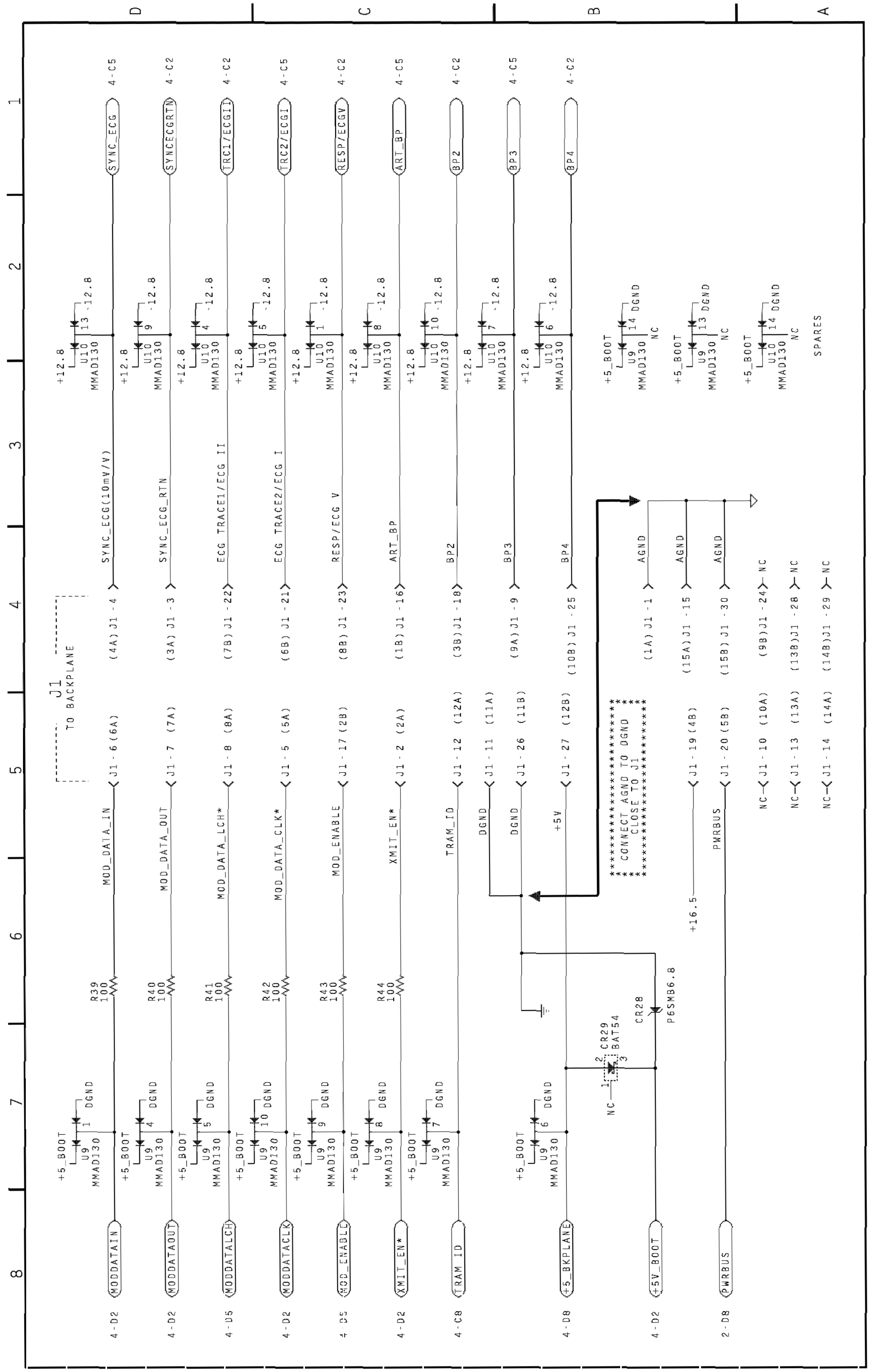

D
C
B
A
1
2
3
4
5
6
7
8
MODDATACLK 5-C8
XMIT_EN* 5-C8
MODDATAOUT 5-D8
MODDATAIN 5-D8
+5V_BOOT 5-B8
BP2 5-C1
BP4 5-B1
TRC1/ECGI1 5-D1
RESP/ECGV 5-C1
SYNCECGRTN 5-D1
PWRBUS 2-D8
J2-22
J2-20
J2-25
J2-23
J2-30
J2-31 +5
J2-32 SPARE
J2-18 -5.0
J2-17 5V
J2-11 SPARE
J2-3
J2-6
J2-8
J2-9
J2-2
J2-15 +12.8
J2-38 SPARE
J2-36 +16.5
J2-40
J2-34
J2-27
J2-21
J2-28
J2-24
J2-26
J2-29 +5
J2-33 +15.5
J2-16 +5.0
J2-19 5V
J2-10 SPARE
J2-1
J2-5
J2-12
J2-7
J2-4
J2-14
J2-13 -12.8
J2-37 +16.5
J2-39
J2-35
MODDATALCH 5-D8
MOD_ENABLE 5-C8
ART_BP 5-C1
BP3 5-B1
TRC2/ECG1 5-C1
SYNC_ECG 5-D1
PWRRTN
BACKPLANE_ID
(7010 OR NONE = OC / TRAM-NET RACK = LOW)
Q13 3904
Q14 3904
R48 10K
R49 10K
R46 10K
R47 10K
+5_BKPLANE 5-B8
TRAM_ID 5-C8
CR19 MBRD340
1 2 3
Q12 IRFR9024
D G S
R38 1K
CR18 MMBD7000
NC
1 2 3
C31 0.1
R37 100K
R36 5K
PWRRTN
PWRRTN
PWRRTN
+16.5

5 of 5


D
C
B
A
1
2
3
4
5
6
7
8
SYNC_ECG
SYNCECGRTN
TRC1/ECGII
TRC2/ECGI
RESP/ECGV
ART_BP
BP2
BP3
BP4
4-C5
4-C2
U10
MMAD130
+12.8
-12.8
SYNC_ECG(10mV/V)
SYNC_ECG_RTN
ECG TRACE1/ECG II
ECG TRACE2/ECG I
RESP/ECG V
ART_BP
(4A) J1-4
(3A) J1-3
(7B) J1-22
(6B) J1-21
(8B) J1-23
(1B) J1-16
(3B) J1-18
(9A) J1-9
(10B) J1-25
(1A) J1-1
(15A) J1-15
(15B) J1-30
(9B) J1-24
(13B) J1-28
(14B) J1-29
NC
AGND
J1
TO BACKPLANE
J1-6 (6A)
J1-7 (7A)
J1-8 (8A)
J1-5 (5A)
J1-17 (2B)
J1-2 (2A)
J1-12 (12A)
J1-11 (11A)
J1-26 (11B)
J1-27 (12B)
J1-19 (4B)
J1-20 (5B)
J1-10 (10A)
J1-13 (13A)
J1-14 (14A)
MOD_DATA_IN
MOD_DATA_OUT
MOD_DATA_LCH*
MOD_DATA_CLK*
MOD_ENABLE
XMIT_EN*
TRAM_ID
DGND
+5V
PWRBUS
+16.5
********************
* CONNECT AGND TO DGND *
* CLOSE TO J1 *
********************
+5_BOOT
U9
MMAD130
SPARES
R39 100
R40 100
R41 100
R42 100
R43 100
R44 100
CR28
P6SMB6.8
CR29
BAT54
MODDATAIN
MODDATAOUT
MODDATALCH
MODDATACLK
MOD_ENABLE
XMIT_EN*
TRAM_ID
+5_BKPLANE
+5V_BOOT
PWRBUS
4-D2
4-D5
4-C8
4-D8
2-D8

*For your notes*

# 23

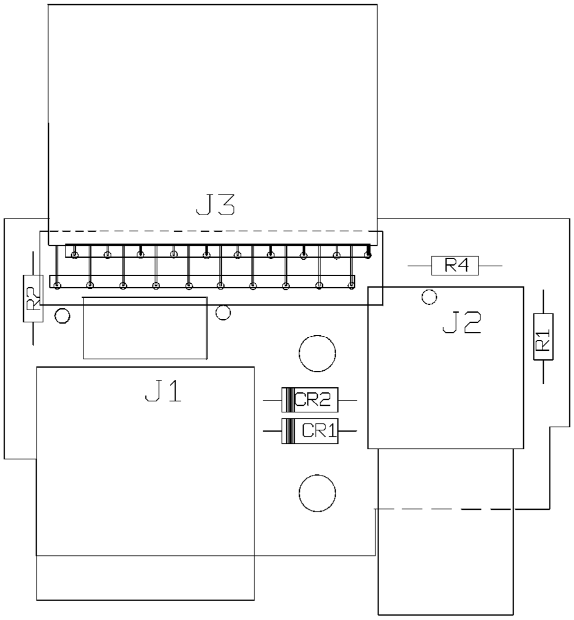
# NON-ISOLATED INPUT PCB PN 401315

Parts Location Diagram PN 401315-003D ........................................23-2

Parts List PN 401315-003D ............................................................23-3

Schematic Diagram PN 401315-003D ...............................................23-4

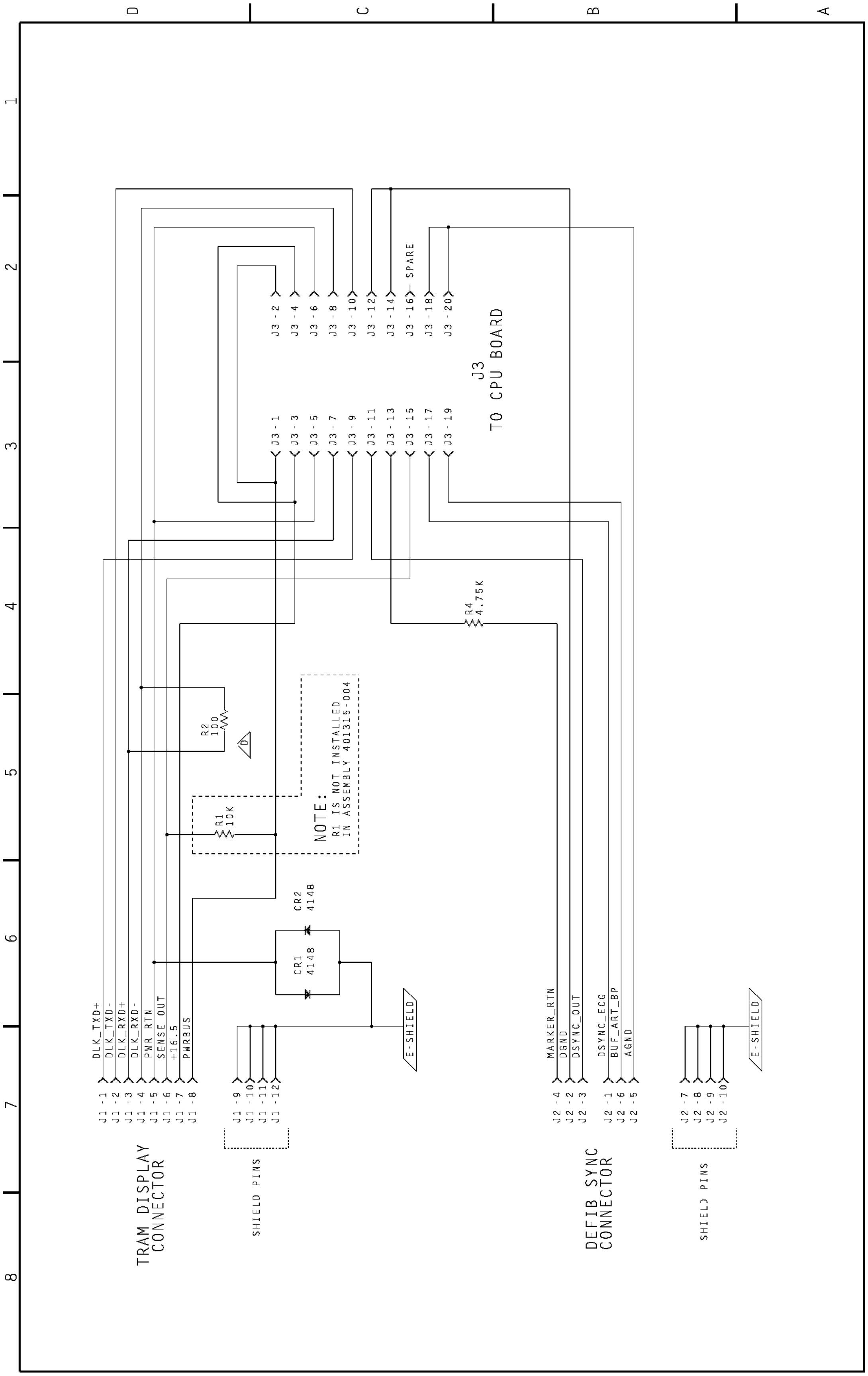
# Parts Location Diagram PN 401315-003D


J3
R4
R2
J2
R1
J1
CR2
CR1

# Parts List PN 401315-003D

| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| CR1, 2 | Diode 1N4148 | 2004-148 | 2 |
| J1 | Conneector, Receptacle 12-Pin | 403934-001 | 1 |
| J2 | Connector, Receptacle, 6-Pin | 403933-001 | 1 |
| J3 | Flex Circuit Assembly | 404149-001 | 1 |
| R1 | Res, MF, 10.0K, 1%, 1/4W | 1023-287 | 1 |
| R2 | Res, MF, 100Ω, 1%, 1/4W | 1023-096 | 1 |
| R4 | Res, MF, 4.75K, 1%, 1/4W | 1023-256 | 1 |
| - | Insulator (Used between J3 and circuit board.) | 404608-001 | 1 |
| - | Circuit Board | 401315-001 | 1 |
| - | Schematic Diagram | 401315-003D | REF |

# Schematic Diagram PN 401315-003D


D
C
B
A
1
2
3
4
5
6
7
8
J3
TO CPU BOARD
J3 - 2
J3 - 4
J3 - 6
J3 - 8
J3 - 10
J3 - 12
J3 - 14
J3 - 16
J3 - 18
J3 - 20
SPARE
J3 - 1
J3 - 3
J3 - 5
J3 - 7
J3 - 9
J3 - 11
J3 - 13
J3 - 15
J3 - 17
J3 - 19
R4
4.75K
R2
100
D
R1
10K
NOTE:
R1 IS NOT INSTALLED
IN ASSEMBLY 401315-004
CR2
4148
CR1
4148
E-SHIELD
DLK_TXD+
DLK_TXD-
DLK_RXD+
DLK_RXD-
PWR_RTN
SENSE_OUT
+16.5
PWRBUS
J1 - 1
J1 - 2
J1 - 3
J1 - 4
J1 - 5
J1 - 6
J1 - 7
J1 - 8
J1 - 9
J1 - 10
J1 - 11
J1 - 12
TRAM DISPLAY
CONNECTOR
SHIELD PINS
MARKER_RTN
DGND
DSYNC_OUT
DSYNC_ECG
BUF_ART_BP
AGND
J2 - 4
J2 - 2
J2 - 3
J2 - 1
J2 - 6
J2 - 5
J2 - 7
J2 - 8
J2 - 9
J2 - 10
DEFIB SYNC
CONNECTOR
SHIELD PINS
E-SHIELD

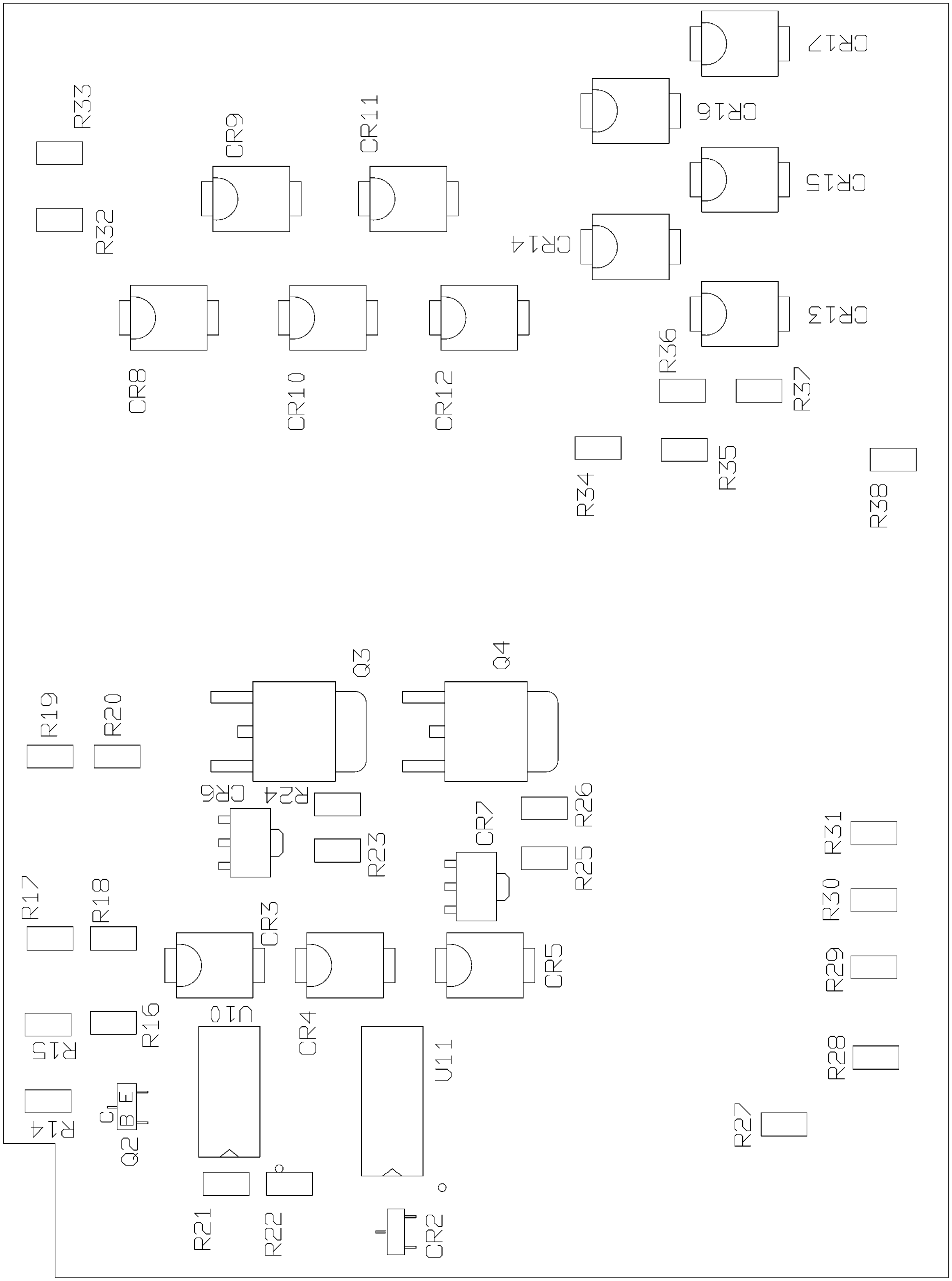
# 24 ISOLATED POWER SUPPLY PN 402329

**Parts Location Diagram PN 402329-002N ........................................24-2**

**Parts List PN 402329-002N ............................................................24-3**

**Schematic Diagram PN 402329-002N ...............................................24-5**

# Parts Location Diagram PN 402329-002N


CR17
CR16
CR15
CR14
CR13
R33
R32
CR9
CR11
CR8
CR10
CR12
R36
R37
R34
R35
R38
Q3
Q4
R19
R20
CR6
R24
R23
R26
CR7
R25
R31
R30
R29
R28
R27
R17
R18
CR3
CR4
CR5
U10
U11
R15
R16
R14
C
B
E
Q2
R21
R22
CR2

# Parts List PN 402329-002N

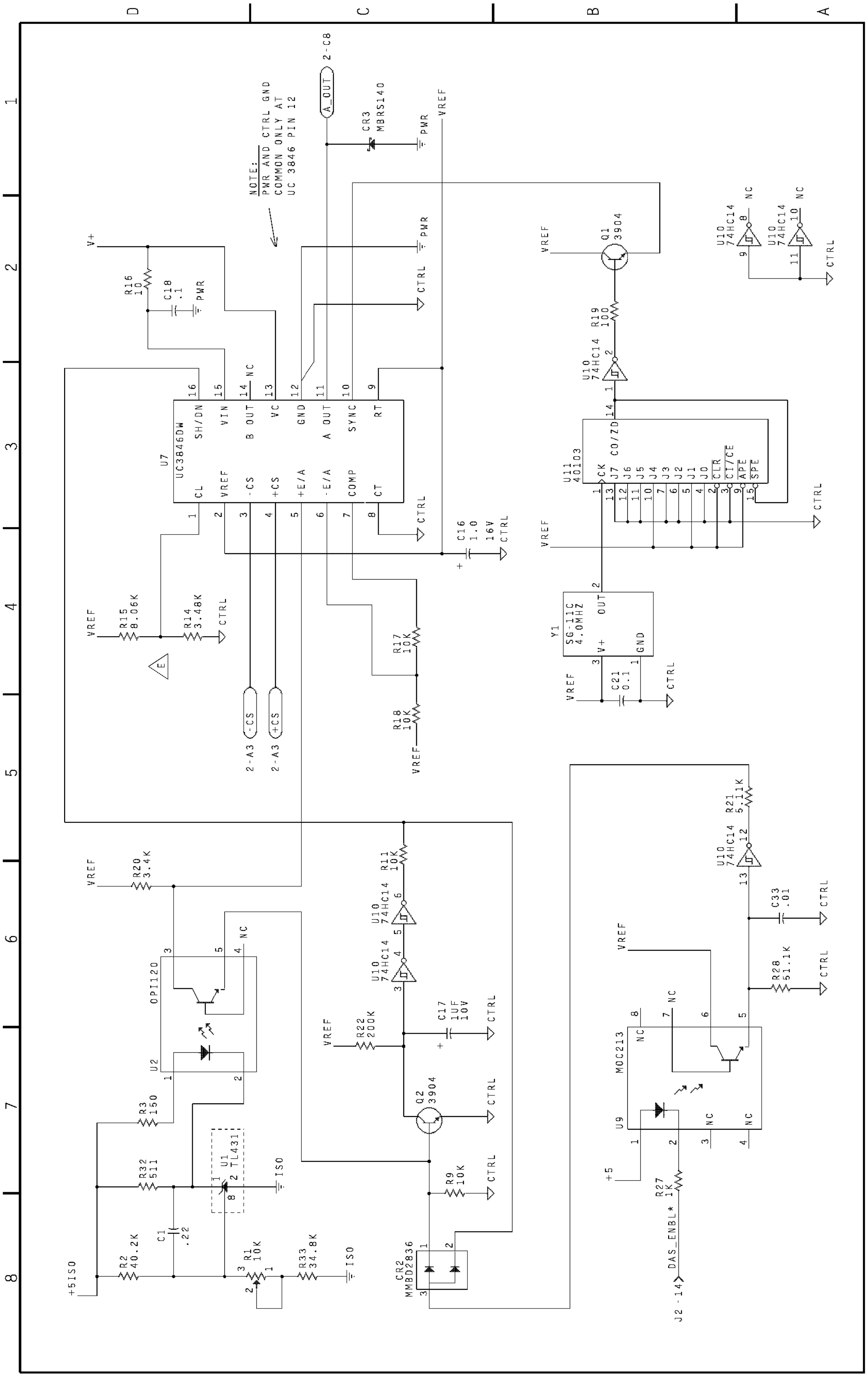
| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| C1 | Cap, Cer, 0.22µF, 20%, 50V, SM | 1187-224 | 1 |
| C2, 3, 4, 10, 11, 12 | Cap, Tant, 82µF, 10%, 10V | 1225-826 | 6 |
| C5 | Cap, Cer, 0.01µF, 10%, 100V, SM | 403029-001 | 1 |
| C6 - 9 | Cap, Tant, 27µF, 10%, 20V | 1135-276 | 4 |
| C13 | Cap, Cer, 270pF, 5%, 50V, SM | 1181-271 | 1 |
| C14, 18, 21, 22, 25, 27, 29, 30, 32 | Cap, Cer, 0.1µF, 20%, 50V | 404370-001 | 9 |
| C15, 31 | Cap, Cer, 100pF, 5%, 50V, SM | 1181-101 | 2 |
| C16, 17 | Cap, Tant, 1µF, 10%, 16V, SM | 403253-001 | 2 |
| C19 | Cap, Cer, 0.001µF, 5%, 50V, SM | 1181-102 | 1 |
| C20 | Cap, Tant, 4.7µF, 20%, 10V, SM | 1176-475 | 1 |
| C23, 24 | Cap, Cer, 0.0022µF, 5%, 100V, SM | 403030-001 | 2 |
| C26, 28 | Cap, Tant, 47µF, 10%, 20V | 1127-476 | 2 |
| C33 | Cap, Cer, 0.01µF, 5%, 50V, SM | 1182-103 | 1 |
| CR1 | Diode Pair, Series, SM D7000 | 2013-201 | 1 |
| CR2 | Diode Pair, Common Anode, SM D2836 | 402544-001 | 1 |
| CR3, 4, 5, 8, 9, 10 | Diode, Schottky, Barrier, 1A, 40V, SM MBRS140T3 | 403187-001 | 6 |
| CR6, 7 | Diode, Zener, SM BZV49C18 | 403007-001 | 2 |
| CR11, 12 | Diode, Rectifier, 1A, 100V, SM MURS110T3 | 403190-001 | 2 |
| CR13, 14, 15 | Diode, Transient Voltage Suppressor, 5V, 600W P6SMB6.8AT1 | 403189-001 | 3 |
| CR16, 17 | Transorb, 15V, 5%, 600W SM6T15A | 403188-001 | 2 |
| E1 | Surge Protector, 7.5kV, 15% | 1931-001 | 1 |
| E2 | Surge Protector, 90V | 1931-101 | 1 |
| J1 | Connector, Vertical, 16-Pin | 1847-016 | 1 |
| J2 | Connector, Vertical, 14-Pin | 1847-014 | 1 |
| L1 - 4 | Inductor, Bead | 1426-001 | 4 |
| L5 | Inductor, Coupled, Critical Component | 403281-001 | 1 |
| L6 | Choke, Common Mode, SM | 403105-001 | 1 |
| Q1, 2 | Transistor, NPN, SM T3904 | 2511-001 | 2 |
| Q3, 4 | Transistor, MOSFET, N-Channel, SM IRFR024 | 403047-001 | 2 |
| R1 | Res, Var, 10K, Top-Adjust | 403282-001 | 1 |
| R2 | Res, Cer, 40.2K, 10%, 1/4W, SM | 1082-792 | 1 |
| R3 | Res, Cer, 150Ω, 1%, 1/8W, SM | 1082-767 | 1 |
| R4 | Res, Cer, 43Ω, 10%, 1/4W, SM | 403025-001 | 1 |
| R5, 6, 9, 11, 17, 18, 30 | Res, Cer, 10K, 1%, 1/8W, SM | 1082-104 | 7 |
| R7 | Res, WW, 0.1Ω, 5%, 1/2W | 1017-003 | 1 |
| R8 | Res, Cer, 240Ω, 5%, 1/8W, SM | 1081-471 | 1 |
| R10, 12 | Res, Cer, 3.3Ω, 10%, 1/4W, SM | 403026-001 | 2 |
| R13, 34, 38 | Res, 340Ω, 1%, 1/8W, SM | 1082-790 | 3 |
| R14 | Res, Cer, 3.48K, 10%, 1/4W, SM | 1082-919 | 1 |

| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| R15 | Res, Cer, 8.06K, 10%, 1/4W, SM | 1082-920 | 1 |
| R16, 39 | Res, Cer, 10Ω, 1%, 1/8W, SM | 1082-786 | 2 |
| R19 | Res, Cer, 100Ω, 1%, 1/8W, SM | 1082-755 | 1 |
| R20 | Res, Cer, 3.4K, 1%, 1/8W, SM | 1082-759 | 1 |
| R21 | Res, Cer, 5.11K, 1%, 1/8W, SM | 1082-784 | 1 |
| R22 | Res, Cer, 200K, 1%, 1/8W, SM | 1082-200 | 1 |
| R23, 25 | Res, Cer, 2.21K, 1%, 1/8W, SM | 1082-787 | 2 |
| R24, 26 | Res, Cer, 22Ω, 5%, 1/8W, SM | 1081-220 | 2 |
| R27 | Res, Cer, 1K, 1%, 1/8W, SM | 1082-103 | 1 |
| R28 | Res, Cer, 51.1K, 10%, 1/4W, SM | 1082-772 | 1 |
| R29, 31, 35 | Res, Cer, 4.75K, 1%, 1/8W, SM | 1082-760 | 3 |
| R32 | Res, Cer, 511Ω, 10%, 1/4W, SM | 1082-794 | 1 |
| R33 | Res, Cer, 34.8K, 10%, 1/4W, SM | 1082-791 | 1 |
| R36 | Res, Cer, 51.1Ω, 10%, 1/4W, SM | 1082-789 | 1 |
| R37 | Res, Cer, 2K, 1%, 1/8W, SM | 1082-201 | 1 |
| T1 | Transformer, SM | 403106-001 | 1 |
| U1 | Volt Rgltr, SM TL431ACD | 403046-001 | 1 |
| U2 | Isolator, Optically Coupled OPI120 | 405050-001 | 1 |
| U3, 8 | Buffer, 3-State Output, Quad, SM HC126 | 403033-001 | 2 |
| U4, 5, 6 | Isolator, Optically Coupled TLP582 | 402153-002 | 3 |
| U7 | Pulse Width Modulator, SM UC3846 | 402990-001 | 1 |
| U9 | Isolator, Optically Coupled, SM MOC213 | 403040-001 | 1 |
| U10 | Inverter, Schmitt Trigger, Hex, SM HC14 | 3038-014 | 1 |
| U11 | Counter, Down, Synchronous, 8-Bit, SM HC40103 | 401432-001 | 1 |
| Y1 | Oscillator, CMOS, 4MHz | 402987-001 | 1 |
| - | Heat Shrink Tubing (Used on L1 - 4) | 404747-001 | AR |
| - | Circuit Board | 402329-001F | 1 |
| - | Schematic Diagram | 402329-003E | – |

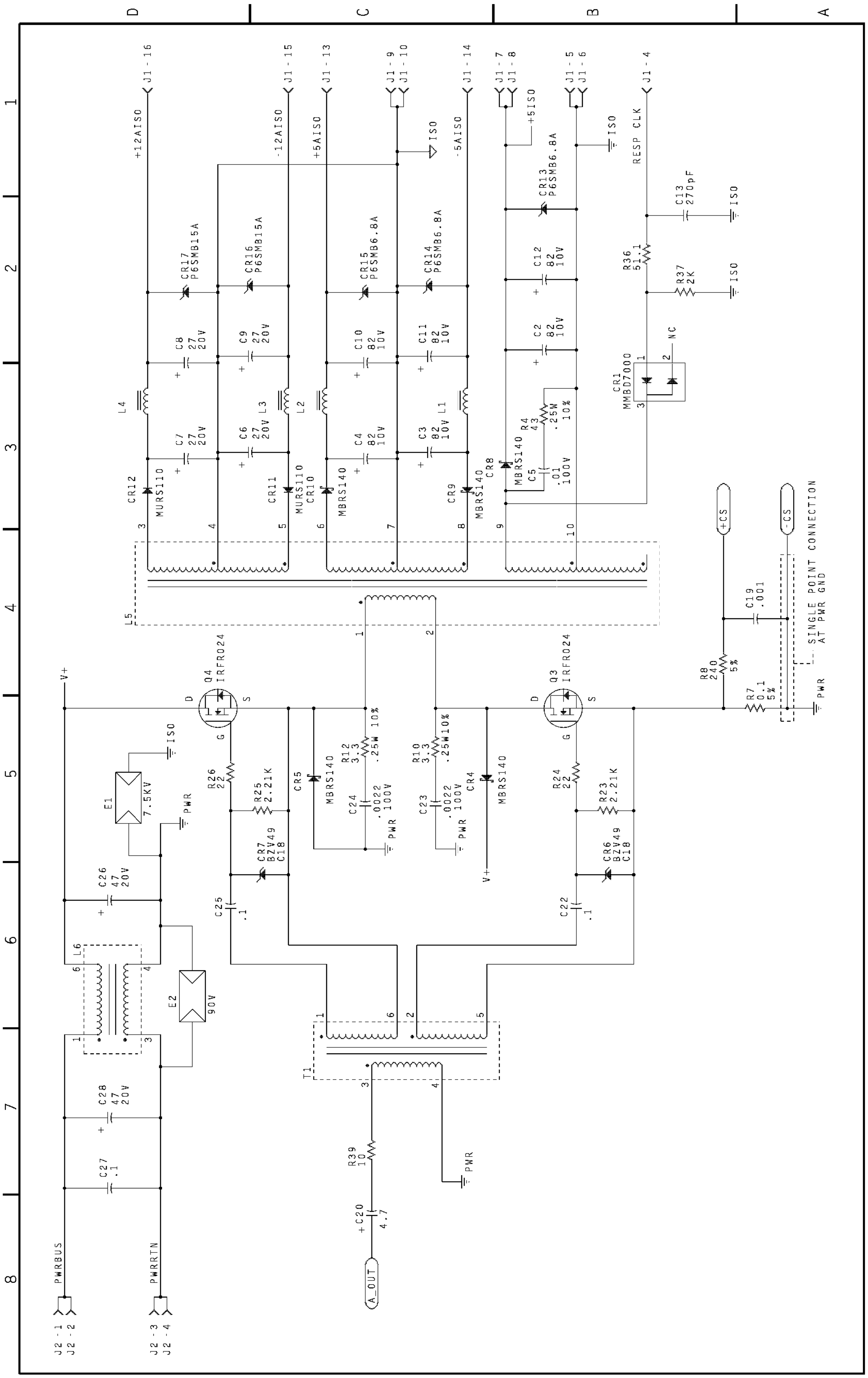
# Schematic Diagram

# PN 402329-002N

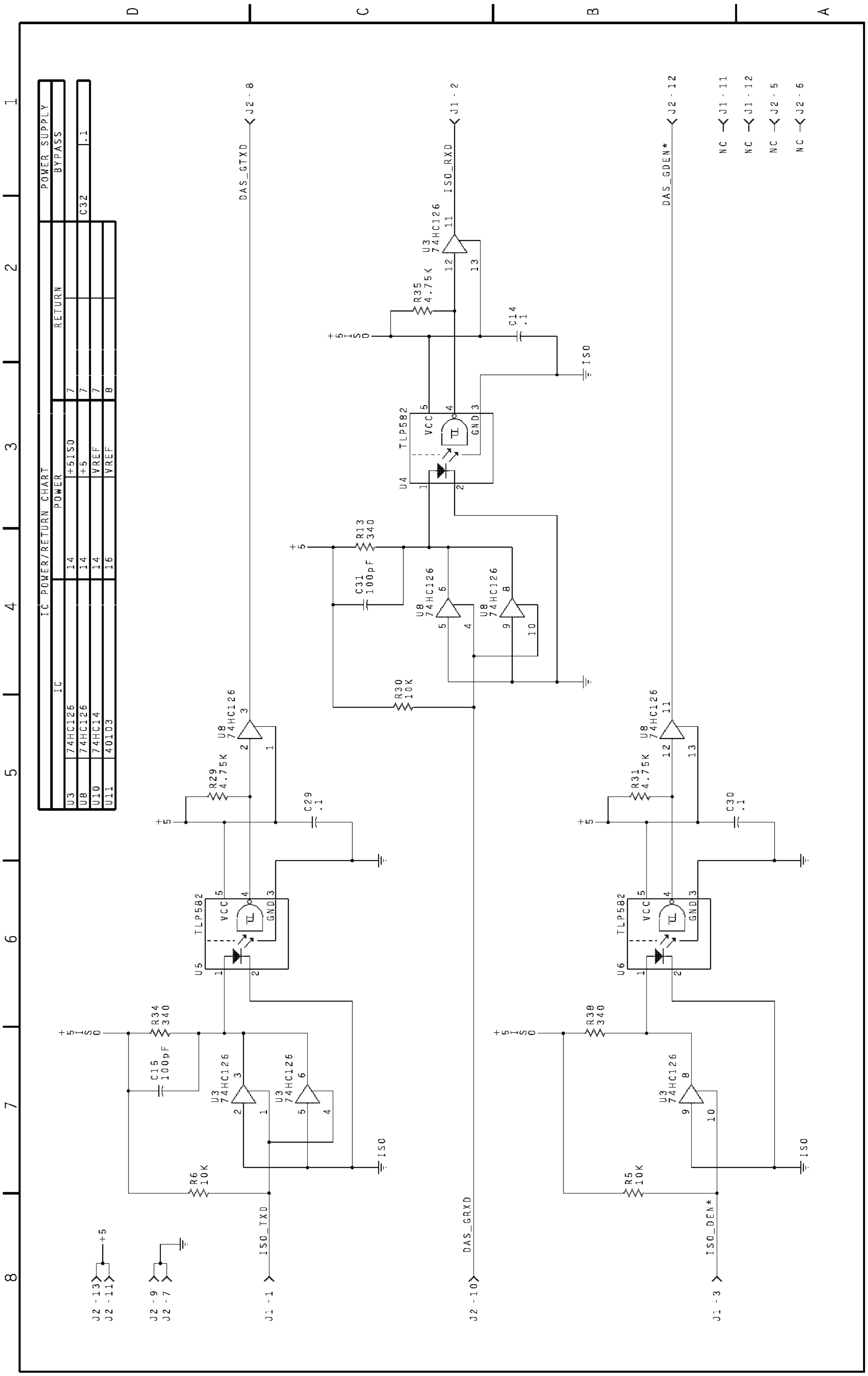
1 of 3


D
C
B
A
1
2
3
4
5
6
7
8
NOTE:
PWR AND CTRL GND
COMMON ONLY AT
UC 3846 PIN 12
A_OUT
2-C8
CR3
MBRS140
PWR
VREF
V+
R16
10
C18
.1
CTRL
U7
UC3846DW
SH/DN
VIN
B OUT
VC
GND
A OUT
SYNC
RT
CL
VREF
-CS
+CS
+E/A
-E/A
COMP
CT
NC
C16
1.0
16V
R15
8.06K
R14
3.48K
R17
10K
R18
10K
-CS
+CS
2-A3
Q1
3904
R19
100
U10
74HC14
U11
40103
CK
CO/ZD
J7
J6
J5
J4
J3
J2
J1
J0
CLR
CI/CE
APE
SPE
Y1
SG-11C
4.0MHZ
OUT
V+
GND
C21
0.1
R20
3.4K
OPI120
U2
R3
150
R32
511
U1
TL431
ISO
C1
.22
R2
40.2K
R1
10K
R33
34.8K
+5ISO
R11
10K
R22
200K
C17
1UF
10V
Q2
3904
R9
10K
CR2
MMBD2836
R21
5.11K
C33
.01
R28
51.1K
MOC213
U9
+5
R27
1K
DAS_ENBL*
J2-14

2 of 3


D
C
B
A
1
2
3
4
5
6
7
8
J1 - 16
J1 - 15
J1 - 13
J1 - 9
J1 - 10
J1 - 14
J1 - 7
J1 - 8
J1 - 5
J1 - 6
J1 - 4
+12AISO
-12AISO
+5AISO
ISO
-5AISO
+5ISO
ISO
RESP CLK
CR17
P6SMB15A
CR16
P6SMB15A
CR15
P6SMB6.8A
CR14
P6SMB6.8A
CR13
P6SMB6.8A
C13
270pF
ISO
R36
51.1
R37
2K
ISO
C12
82
10V
C8
27
20V
C9
27
20V
C10
82
10V
C11
82
10V
C2
82
10V
NC
CR1
MMBD7000
1
2
3
L4
L3
L2
L1
C7
27
20V
C6
27
20V
C4
82
10V
C3
82
10V
R4
43
.25W
10%
CR8
MBRS140
C5
.01
100V
CR12
MURS110
CR11
MURS110
CR10
MBRS140
CR9
MBRS140
3
4
5
6
7
8
9
10
+CS
-CS
SINGLE POINT CONNECTION
AT PWR GND
C19
.001
L5
1
2
V+
Q4
IRFR024
D
G
S
Q3
IRFR024
D
G
S
R8
240
5%
R7
0.1
5%
PWR
ISO
E1
7.5KV
PWR
R26
22
R25
2.21K
CR5
MBRS140
R12
3.3
.25W 10%
C24
.0022
100V
PWR
R10
3.3
.25W10%
C23
.0022
100V
PWR
CR4
MBRS140
V+
R24
22
R23
2.21K
CR7
BZV49
C18
CR6
BZV49
C18
C26
47
20V
C25
.1
C22
.1
L6
6
4
1
3
E2
90V
1
6
2
5
T1
3
4
C28
47
20V
C27
.1
R39
10
PWR
C20
4.7
A_OUT
PWRBUS
PWRRTN
J2 - 1
J2 - 2
J2 - 3
J2 - 4

3 of 3


D
C
B
A
1
2
3
4
5
6
7
8
DAS_GTXD
J2-8
ISO_RXD
J1-2
DAS_GDEN*
J2-12
NC J1-11
NC J1-12
NC J2-5
NC J2-6
U3 74HC126
R35 4.75K
C14 .1
+5ISO
ISO
U4 TLP582
VCC
GND
R13 340
+5
C31 100pF
U8 74HC126
R30 10K
R29 4.75K
C29 .1
U5 TLP582
R34 340
C15 100pF
R6 10K
ISO_TXD
J1-1
DAS_GRXD
J2-10
R31 4.75K
C30 .1
U6 TLP582
R38 340
R5 10K
ISO_DEN*
J1-3
J2-13
J2-11
J2-9
J2-7

IC POWER/RETURN CHART

| IC | | POWER | | RETURN |
|---|---|---|---|---|
| U3 | 74HC126 | 14 | +5ISO | 7 |
| U8 | 74HC126 | 14 | +5 | 7 |
| U10 | 74HC14 | 14 | VREF | 7 |
| U11 | 40103 | 16 | VREF | 8 |

POWER SUPPLY BYPASS

| | |
|---|---|
| C32 | .1 |

*For your notes*

# 25

# POWER INDICATOR PCB

# PN 403170/800006

**Parts Location Diagram PN 403170-008B/009A/011A ....................25-2**

**Parts List PN 403170-008B/009A/011A .........................................25-3**

**Schematic Diagram PN 403170-008B/009A/011A ..........................25-4**

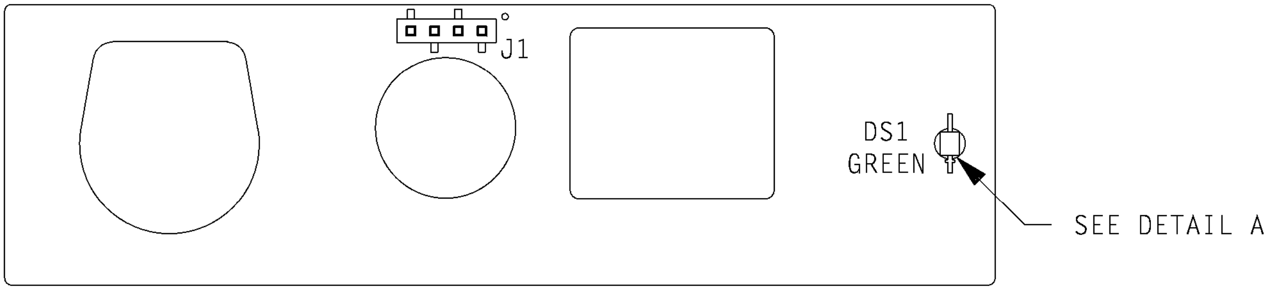
**Parts Location Diagram PN 800006-001D ........................................25-5**

**Parts List PN 800006-001D .............................................................25-6**

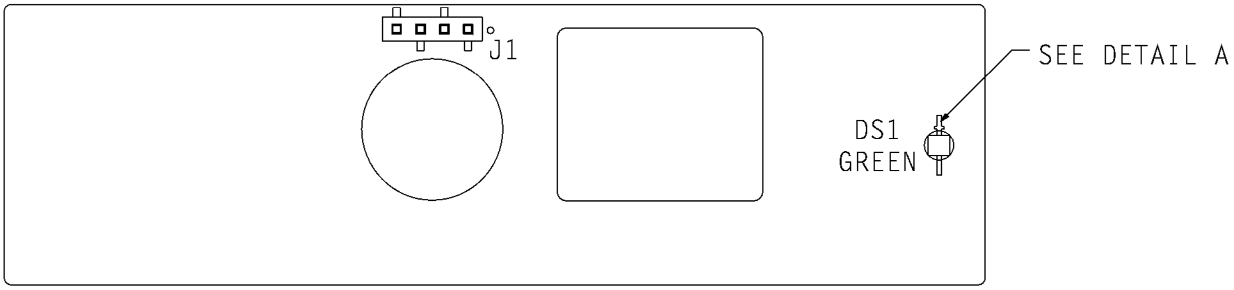
**Schematic Diagram PN 800006-001D ..............................................25-7**

# Parts Location Diagram PN 403170-008B/009A/011A

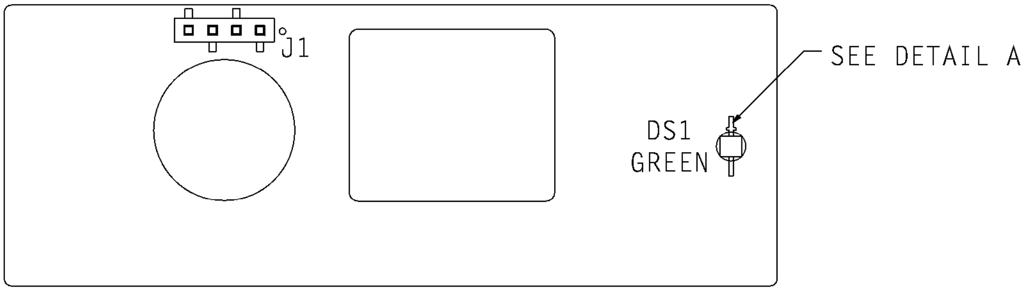
PN 403170-008

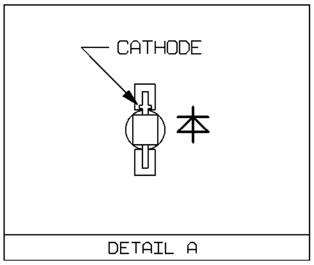

J1
DS1
GREEN
SEE DETAIL A

PN 403170-009


J1
SEE DETAIL A
DS1
GREEN

PN 403170-011

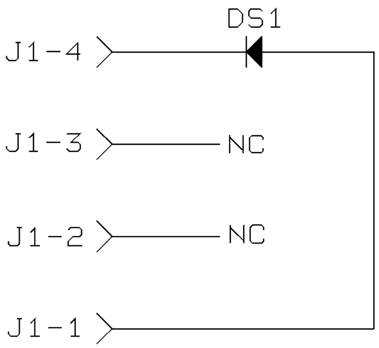

J1
SEE DETAIL A
DS1
GREEN


CATHODE
DETAIL A

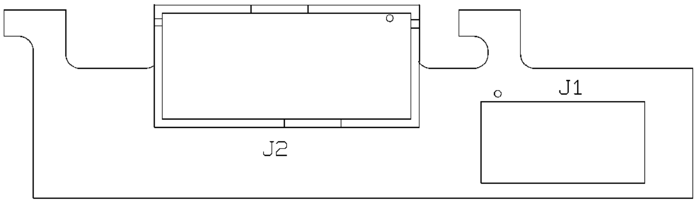
# Parts List PN 403170-008B/009A/011A

| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| J1 | Connector, Male, 4-Pin | 405237-002 | 1 |
| DS1 | Diode, Light-Emitting, SM, Green | 405033-022 | 1 |
| - | Circuit Board (Use on PN 403170-008 Only) | 403170-005 | 1 |
| - | Circuit Board (Use on PN 403170-009 Only) | 403170-007 | 1 |
| - | Circuit Board (Use on PN 403170-011 Only) | 403170-010 | 1 |

# Schematic Diagram PN 403170-008B/009A/011A


DS1
J1-4
J1-3
NC
J1-2
NC
J1-1

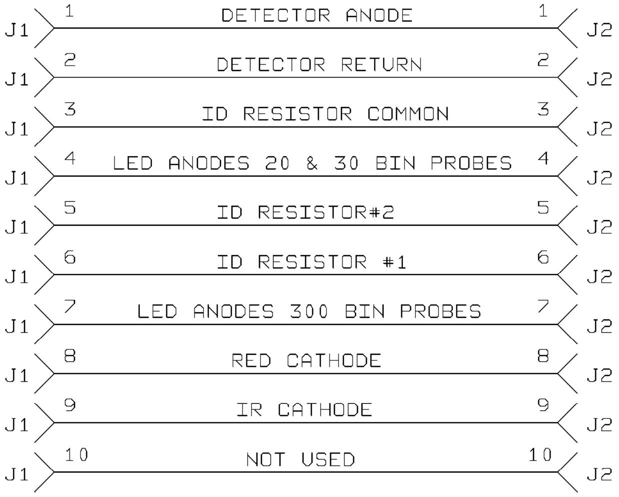
# Parts Location Diagram PN 800006-001D



# Parts List PN 800006-001D

| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| J1 | Connector, Vertical, 10-Pin | 1847-010 | 1 |
| J2 | Connector, PC Header, 10-Pin | 1823-310 | 1 |
| - | Circuit Board | 800007-001 | 1 |

# Schematic Diagram PN 800006-001D


J1
1
DETECTOR ANODE
1
J2
2
DETECTOR RETURN
2
3
ID RESISTOR COMMON
3
4
LED ANODES 20 & 30 BIN PROBES
4
5
ID RESISTOR#2
5
6
ID RESISTOR #1
6
7
LED ANODES 300 BIN PROBES
7
8
RED CATHODE
8
9
IR CATHODE
9
10
NOT USED
10

*For your notes*

# 26 FAN ASSEMBLY

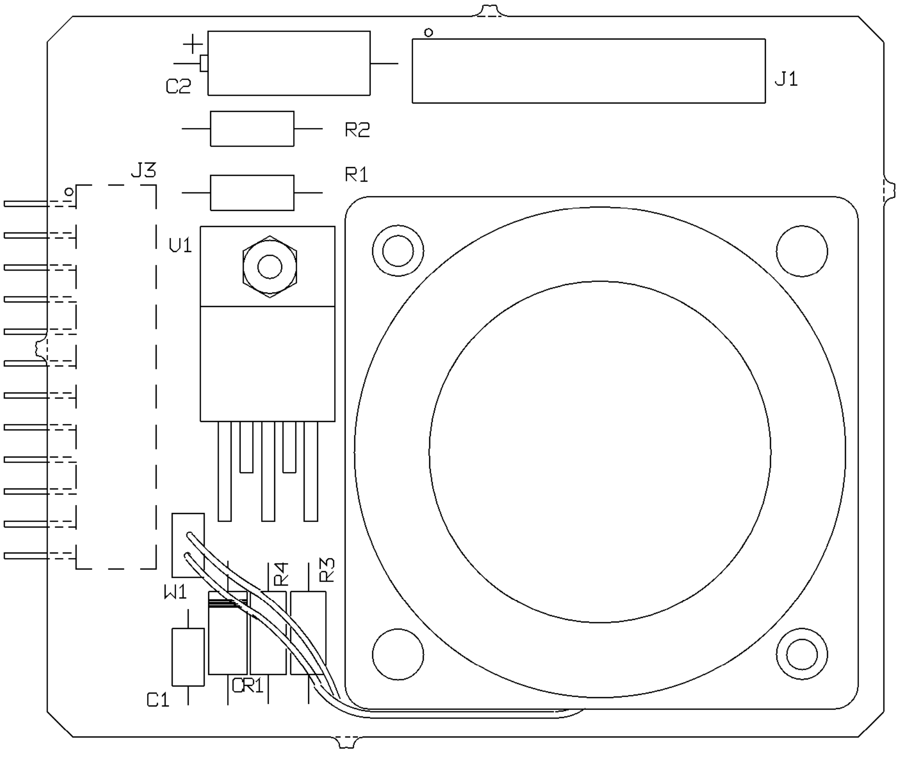
# PN 403549

**Parts Location Diagram PN 403549-002F** ........................................ **26-2**

**Parts List PN 403549-002F** ............................................................ **26-3**

**Schematic Diagram PN 403549-003B** ............................................... **26-4**

# Parts Location Diagram PN 403549-002F

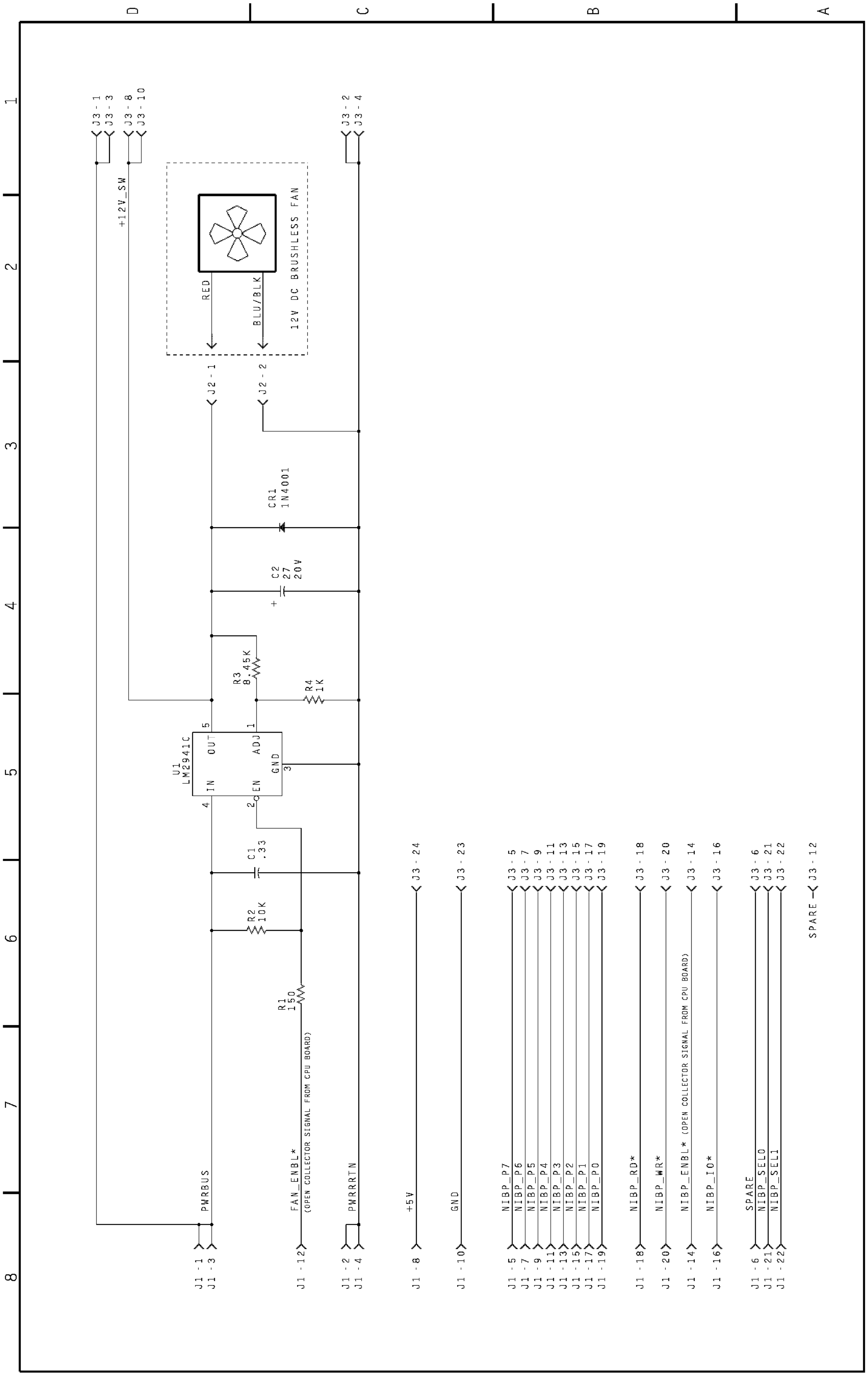

C2
J1
R2
R1
J3
U1
W1
R4
R3
C1
CR1

# Parts List PN 403549-002F

| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| C1 | Cap, Cer, 0.33µF, +80/-20%, 50V | 1110-334 | 1 |
| C2 | Cap, Tant, 27µF, 10%, 20V | 1135-276 | 1 |
| CR1 | Diode, Rectifier, 2A, 50V 1N4001 | 2401-001 | 1 |
| J1 | Connector, Receptacle, 22-Pin | 404212-001 | 1 |
| J3 | Connector, PC Header, 24-Pin | 1848-124 | 1 |
| R1 | Res, MF, 150Ω, 1%, 1/8W | 1010-113 | 1 |
| R2 | Res, MF, 10.0K, 1%, 1/8W | 1010-287 | 1 |
| R3 | Res, MF, 8.45K, 1%, 1/8W | 1010-280 | 1 |
| R4 | Res, MF, 1.0K, 1%, 1/8W | 1010-191 | 1 |
| U1 | Volt Rgltr, Adj, TO220 LM2941CT | 403609-001 | 1 |
| - | Fan, 12 V dc, 4.6 CFM | 404741-001 | 1 |
| - | Screw, 8-32 x 3/8 | 404982-001 | 2 |
| - | Nut, Hex, Nylon, 4-40 | 405141-001 | 1 |
| - | Washer, Nylon, No 5 | 4550-105 | 1 |
| - | Screw, PNH, Nylon, 4-40 x 1/4 | 4779-408 | 1 |
| - | Circuit Board | 403549-001B | 1 |
| - | Schematic Diagram | 403549-003B | REF |

# Schematic Diagram

# PN 403549-003B


D
C
B
A
1
2
3
4
5
6
7
8
J3 - 1
J3 - 3
J3 - 8
J3 - 10
J3 - 2
J3 - 4
+12V_SW
RED
BLU/BLK
12V DC BRUSHLESS FAN
J2 - 1
J2 - 2
CR1
1N4001
C2
27
20V
+
R3
8.45K
R4
1K
U1
LM2941C
OUT
ADJ
IN
EN
GND
5
1
4
2
3
C1
.33
R2
10K
R1
150
PWRBUS
FAN_ENBL*
(OPEN COLLECTOR SIGNAL FROM CPU BOARD)
PWRRTN
+5V
GND
NIBP_P7
NIBP_P6
NIBP_P5
NIBP_P4
NIBP_P3
NIBP_P2
NIBP_P1
NIBP_P0
NIBP_RD*
NIBP_WR*
NIBP_ENBL* (OPEN COLLECTOR SIGNAL FROM CPU BOARD)
NIBP_IO*
SPARE
NIBP_SEL0
NIBP_SEL1
J3 - 24
J3 - 23
J3 - 5
J3 - 7
J3 - 9
J3 - 11
J3 - 13
J3 - 15
J3 - 17
J3 - 19
J3 - 18
J3 - 20
J3 - 14
J3 - 16
J3 - 6
J3 - 21
J3 - 22
SPARE
J3 - 12
J1 - 1
J1 - 3
J1 - 12
J1 - 2
J1 - 4
J1 - 8
J1 - 10
J1 - 5
J1 - 7
J1 - 9
J1 - 11
J1 - 13
J1 - 15
J1 - 17
J1 - 19
J1 - 18
J1 - 20
J1 - 14
J1 - 16
J1 - 6
J1 - 21
J1 - 22

# 27

# MODULE PROCESSOR PCB PN 800210

**General** .......................................................................... 27-2

**Parts Location Diagram PN 800210-005B** ......................................... 27-3

**Parts List PN 800210-005B** .............................................................. 27-4

**Schematic Diagram PN SD800210-002B** ............................................ 27-7

**Assembly Revisions PN 800210** ........................................................ 27-27

**Parts List PN 800210-001E/002B** ...................................................... 27-28

**Schematic Diagram PN SD800210-001C** ............................................ 27-31

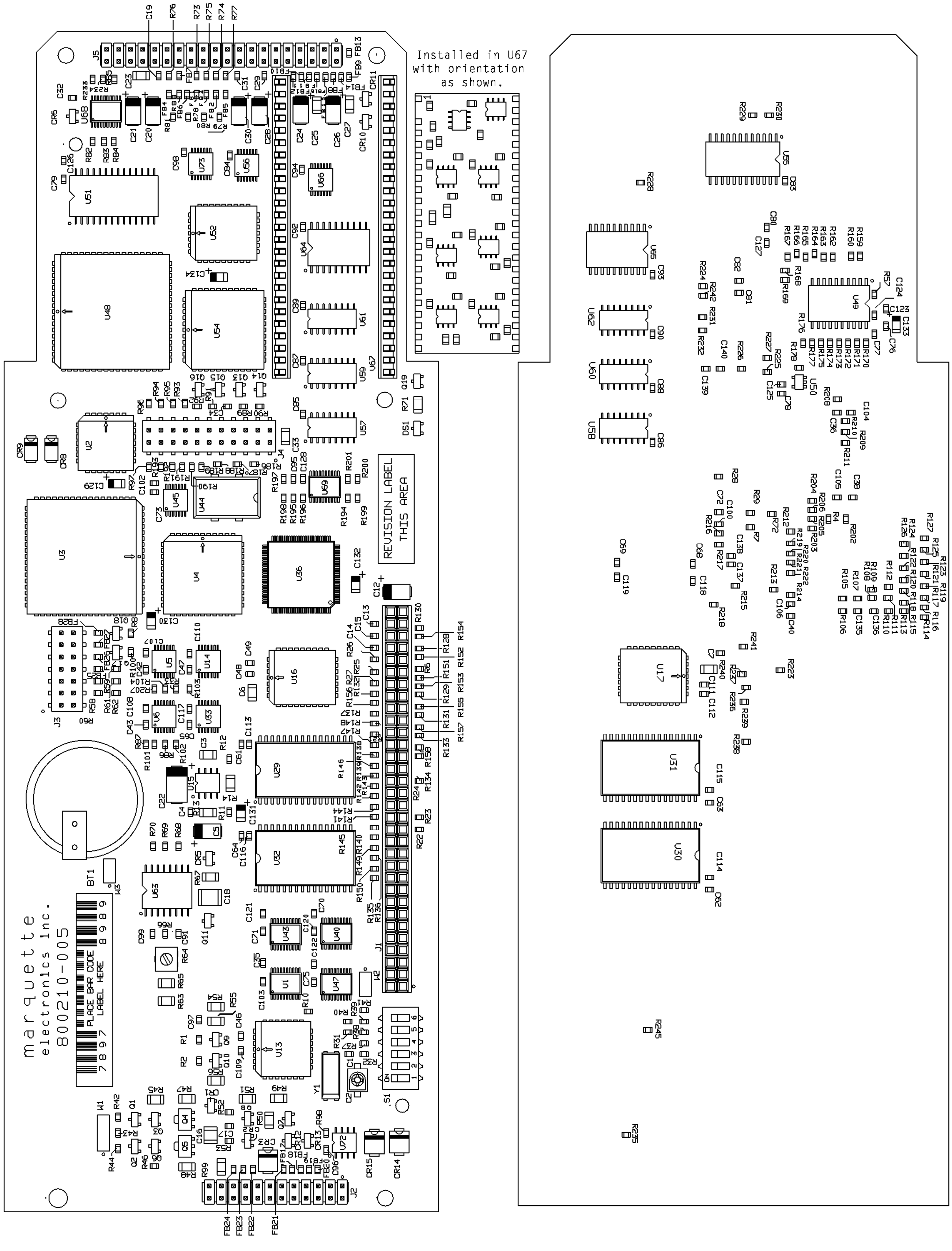
# General

There are three different versions of the module processor PCB:

- pn 800210-001, which was used first in all of the A-series modules; and
- pn 800210-002, which was introduced in the SL-series modules, and then added to the A-series modules; and
- pn 800210-005 replaced both of the first two versions.

**NOTE**
You may replace either version -001 or -002 board with a -005 board, but do not replace a -005 with a -001 or -002 circuit board.

# Parts Location Diagram PN 800210-005B


Installed in U67
with orientation
as shown.
REVISION LABEL
THIS AREA
marquette
electronics inc.
800210-005
PLACE BAR CODE
LABEL HERE
7897 8989
J1
J2
J3
J4
J5
BT1
S1
Y1
W1
W2
W3
U1
U2
U3
U4
U5
U6
U13
U14
U15
U16
U17
U29
U30
U31
U32
U33
U36
U40
U43
U44
U45
U47
U48
U49
U50
U51
U52
U54
U55
U56
U57
U58
U59
U60
U61
U62
U63
U64
U65
U66
U67
U68
U69
U72
U73
CR6
CR8
CR9
CR10
CR11
CR14
CR15
DS1
FB21
FB22
FB23
FB24
C19
R76
R73
R75
R74
R77

# Parts List PN 800210-005B

| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| BT1 | Battery, Lithium, 3V, Disk | 413191-001 | 1 |
| C1 | Cap, NPO, 27pF, 5%, 50V, SM | 411576-019 | 1 |
| C2 | Cap, Var, 4 - 25pF, SM | 401977-001 | 1 |
| C3, 6, 7, 23, 25, 27, 33 | Cap, Cer, 0.1µF, 20%, 50V | 404370-001 | 7 |
| C4, 97 | Cap, Cer, 0.1µF, 5%, 50V, SM | 411575-012 | 2 |
| C5, 24, 26 | Cap, Tant, 4.7µF, 20%, 20V, SM | 402004-001 | 3 |
| C12, 20, 21, 28, 30 | Cap, Tant, 10µF, 20%, 16V, SM | 1176-106 | 5 |
| C13-15, 17, 19, 29, 31, 32, 34-36, 38, 40, 42, 43, 46-48, 61-65, 68-73, 75-81, 83-96, 98, 99, 112, 136, 137, 140 | Cap, Cer, 0.1µF, 5%, 16V | 411575-002 | 56 |
| C16 | Cap, Cer, 0.22µF, 20%, 50V, SM | 1187-224 | 1 |
| C18 | Cap, Cer, 0.47µF, 20% | 1187-474 | 1 |
| C22 | Cap, Tant, 10µF, 20%, 25V, SM | 1152-106 | 1 |
| C49, 82, 100, 102-111, 113-128, 135, 138, 139 | Cap, Cer, 1000pF, 5%, 50V, SM | 411575-003 | 32 |
| C129-134 | Cap, Tant, 1.0µF, 10%, 16V, SM | 406883-002 | 6 |
| CR1, 6 | Diode, Schottky, SM BAT54 | 401985-001 | 2 |
| CR2, 10, 11, 12, 13 | Diode Pair, Series, SM D7000 | 2013-201 | 5 |
| CR3 | Diode, Transient Voltage Suppression, SM P6SMB20AT1 | 403939-001 | 1 |
| CR5 | Diode, SM MMAD4148 | 401980-001 | 1 |
| CR8, 9 | Diode, Schottky, Barrier, 1A, 40V, SM MBRS140T3 | 403187-001 | 2 |
| CR14, 15 | Diode, Transient Voltage Suppressor, Bi-Directional, 6.8V, 600W | 404121-001 | 1 |
| DS1 | Diode, Light-Emitting (Red/Green) LDGR 2340 | 402428-001 | 1 |
| FB1-4, 7-16, 21-24, 28 | Ferrite Bead BLM11A20 | 414061-001 | 19 |
| FB5, 6, 17-20, 25-27 | Ferrite Bead BLM11A12 | 416171-001 | 9 |
| J1 | Connector, PC Header, 64-Pin | 1847-064 | 1 |
| J2 | Connector, PC Header, 24-Pin, Vertical | 1778-224 | 1 |
| J3 | Connector, PC Header, 14-Pin | 416146-001 | 1 |
| J4 | Connector, PC Header, 22-Pin | 416146-002 | 1 |
| J5 | Connector, PC Header, 40-Pin | 1778-240 | 1 |
| Q1-3, 6-10, 14, 16, 18, 19 | Transistor, NPN, SM T3904 | 2511-001 | 12 |
| Q4, 5 | Transistor, NPN, SM BCX56-1 | 2712-056 | 2 |
| Q11 | Transistor, PNP, SM T4403 | 401978-001 | 1 |
| Q13, 15, 17 | Transistor, PNP, SM T3906 | 2511-101 | 3 |
| R1, 2, 28, 57, 69, 70 | Res, Cer, 1K, 1%, 1/16W, SM | 410334-008 | 6 |

| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| R4, 72, 143-158, 202 | Res, Cer, 100Ω, 1%, 1/16W, SM | 410334-003 | 19 |
| R6, 10-12, 22-24, 26, 27, 31, 32, 37-41, 44, 52, 53, 58, 59, 68, 88, 98, 128-142 | Res, Cer, 10K, 1%, 1/16W, SM | 410334-013 | 39 |
| R7, 105-127, 203-206, 208-222, 224-227, 229, 230, 242, 245 | Res, Cer, 30.1Ω, 1%, 1/16W, SM | 410334-109 | 1 |
| R8, 46, 90, 92 | Res, Cer, 1.50K, 1%, 1/16W, SM | 410334-080 | 4 |
| R13 | Res, Cer, 200K, 0.1%, 1/8W, SM | 1067-832 | 1 |
| R14 | Res, Cer, 22.9K, 0.1%, 1/8W, SM | 1067-833 | 1 |
| R21, 60-62, 93-97, 186-193 | Res, Cer, 150Ω, 1%, 1/16W, SM | 410334-028 | 17 |
| R25, 29, 33, 82, 83-87, 194-201 | Res, Cer, 100K, 1%, 1/16W, SM | 410334-019 | 17 |
| R42, 43, 73, 74-77, 89, 91, 100 | Res, Cer, 4.75K, 1%, 1/16W, SM | 410334-010 | 10 |
| R45, 49, 54 | Res, Cer, 3.4K, 1%, 1/8W, SM | 1082-759 | 3 |
| R47, 48 | Res, Cer, 49.9 Ω, 1%, 1/8W, SM | 1082-799 | 2 |
| R50, 55, 56 | Res, Cer, 34.8K, 10%, 1/4W, SM | 1082-791 | 3 |
| R51 | Res, Cer, 249 Ω, 1%, 1/8W, SM | 1082-793 | 1 |
| R63 | Res, Cer, 2.4M, 5%, 1/8W, SM | 1081-484 | 1 |
| R64 | Res, Var, 500K, Top Adjust | 401979-001 | 1 |
| R65 | Res, Cer, 3.9M, 5%, 1/8W, SM | 1081-485 | 1 |
| R66 | Res, Cer, 200Ω, 1%, 1/16W, SM | 410334-044 | 1 |
| R67 | Res, Cer, 22M, 5%, 1/8W, SM | 1081-486 | 1 |
| R71, 99 | Res, 340 Ω, 1%, 1/8W, SM | 1082-790 | 2 |
| R78-81 | Res, Cer, 681Ω, 1%, 1/16W, SM | 410334-065 | 4 |
| R101-104, 159, 160,162-178, 207, 223, 228, 231-241 | Res, Cer, 49.9Ω, 1%, 1/16W, SM | 410334-040 | 37 |
| S1 | Switch, Dual In-Line, 6-Station, SM | 401960-001 | 1 |
| U1, 43, 47 | Buffer/Driver, Octal, SM VHC541 | 3057-541 | 3 |
| U2 | EPLD, 68000 Interrupt Encoder, PLCC | 404570-001 | 1 |
| U3 | Microprocessor, 16-MHz, PLCC 68HC000 | 401968-001 | 1 |
| U4 | EPLD, 68000 Bus Control, PLCC | 408137-004 | 1 |
| U5, 66 | Inverter, Hex, SM VHC04 | 3057-004 | 2 |
| U6, 14, 33, 56 | OR Gate, 2-Input, Quad , SM VHC32 | 3057-032 | 5 |
| U13 | Clock/Timer, SM DP8570 | 401970-001 | 1 |
| U15 | Volt Rgltr, Adj, SM LP2951A | 3076-001 | 1 |
| U16, 17 | EEPROM, Flash, 2K x 8-Bit, 90nS, PLCC | 408792-002 | 2 |
| U29, 30, 31, 32 | RAM, Static, 128K x 8-Bit, 70nS, SM 628128 | 406255-002 | 4 |
| U36 | RAM, CMOS, Dual Port, 64K x 8-Bit, SM TQFP | 415860-001 | 1 |
| U40, 69 | Transceiver, Bus, Octal, SM VHC245 | 3057-245 | 2 |
| U44 | Oscillator, CMOS, 14.7456MHz, SM | 401480-001 | 1 |

| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| U45 | Flip-Flop, Type D, Dual, SM VHC74 | 3057-074 | 1 |
| U48 | PAL, Programmed, Communication Control, PLCC 80C152JB | 400368-001 | 1 |
| U49 | Latch, Transparent, Three-State Output, Octal, SM HC573 | 401971-001 | 1 |
| U50 | EPROM, Programmed, Boot Code, PLCC | 409035-001 | 1 |
| U51 | RAM, Static, 32K x 8-Bit , SM 62256FLP | 3202-256 | 1 |
| U52 | EPROM, Programmed, 80C152 Boot Code, PLCC | 404904-002 | 1 |
| U54 | EPLD, Communication Interface, PLCC | 408139-001 | 1 |
| U55 | Decoder/Demultiplexer, 4-Line-to-16-Line, SM HC154 | 404210-001 | 1 |
| U57, 58 | Shift Register, 8-Bit, Serial Input, Serial/Parallel Output, Tri-State Output, SM HC595 | 401969-001 | 2 |
| U59, 60, 61, 62 | Shift Register, Parallel Load, 8-Bit, SM HC165 | 401972-001 | 4 |
| U63 | Microprocessor Support Circuit, SM MAX695 | 401966-001 | 1 |
| U64, 65 | Register, 8-Bit, SM HC273 | 3038-273 | 2 |
| U67 | Hybrid, Analog Output | 401205-001 | 1 |
| U68 | Buffer, Three-State Output, Octal, SM VHC244 | 3057-244 | 1 |
| U72 | Line Driver/Receiver, Differential, SM DS8921AM | 404013-001 | 1 |
| W1-1, W1-2, W1-3, W2-1, W2-2, W3-1, W3-2 | Socket, Mini | 1818-201 | 7 |
| Y1 | Crystal, 32.768kHz, SM | 402085-001 | 1 |
| - | Jumper, Mini | 1859-201 | 2 |
| - | Lubricant, Anti-Fretting (For U67) | 410286-001 | 1 |
| - | Mounting Pad, Battery (For BT1) | 404368-001 | 1 |
| - | Insulator, Battery (For BT1) | 415683-001 | 1 |
| - | Socket, Hybrid (For U67) | 404596-001 | 2 |
| - | Circuit Board | 800211-002A | 1 |
| - | Schematic Diagram | SD800210-002B | - |

# Schematic Diagram

# PN SD800210-002B

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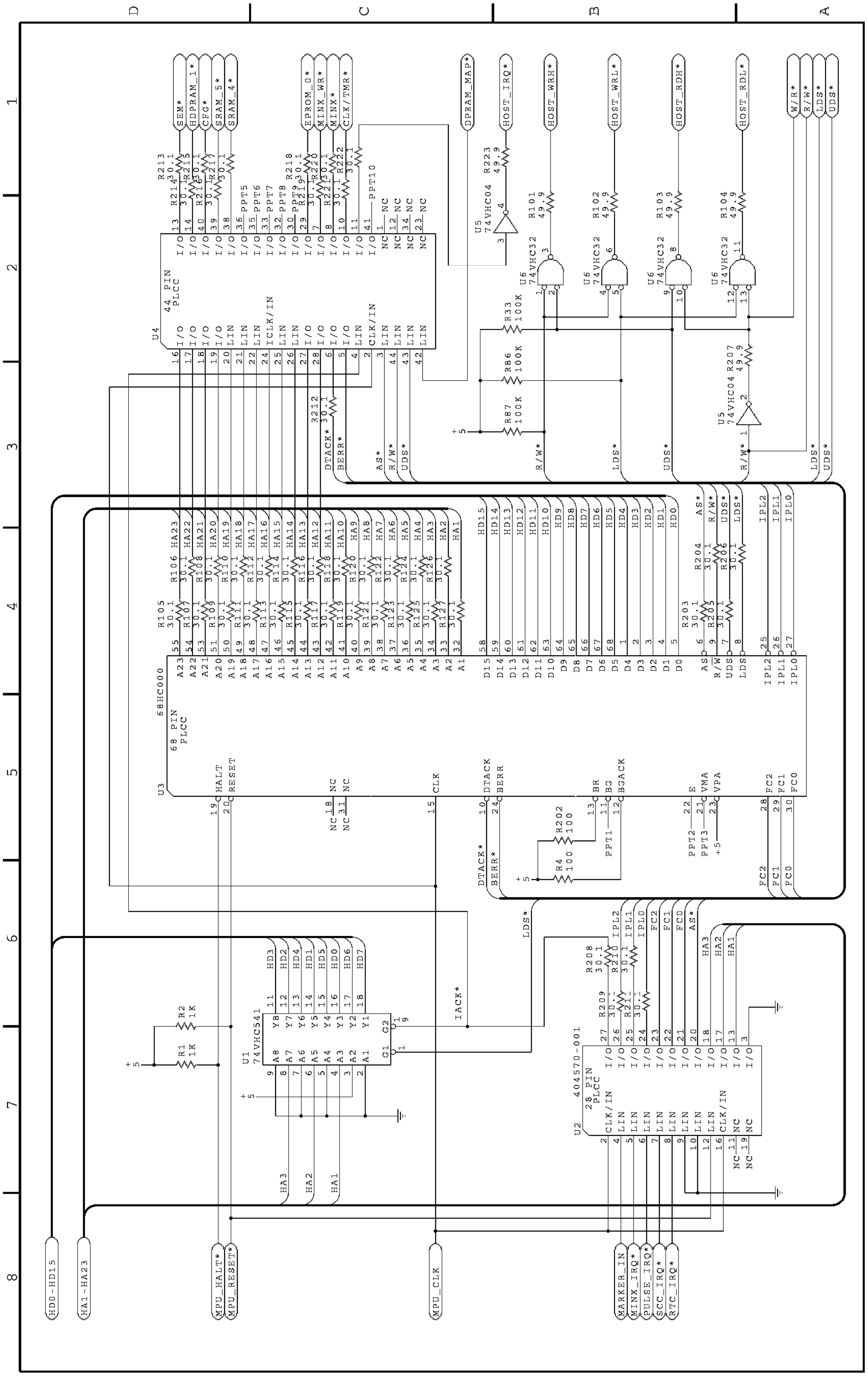
**NOTE:** For PN 800210-005 PCB


D
C
B
A
1
2
3
4
5
6
7
8
SEM*
HDPRAM_1*
CFG*
SRAM_5*
SRAM_4*
EPROM_0*
MINX_WR*
MINX*
CLK/TMR*
DPRAM_MAP*
HOST_IRQ*
HOST_WRH*
HOST_WRL*
HOST_RDH*
HOST_RDL*
W/R*
R/W*
LDS*
UDS*
U4
44 PIN
PLCC
U5
74VHC04
U6
74VHC32
R33 100K
R86 100K
R87 100K
R207 49.9
R101 49.9
R102 49.9
R103 49.9
R104 49.9
R223 49.9
R212 30.1
DTACK*
BERR*
AS*
U3
68HC000
68 PIN
PLCC
HALT
RESET
CLK
DTACK
BERR
BR
BG
BGACK
E
VMA
VPA
FC2
FC1
FC0
IPL2
IPL1
IPL0
R202 100
R4 100
PPT1
PPT2
PPT3
+5
IACK*
U1
74VHC541
R1 1K
R2 1K
G1
G2
HA3
HA2
HA1
U2
404570-001
28 PIN
PLCC
R208 30.1
R209 30.1
R210 30.1
R211 30.1
HD0-HD15
HA1-HA23
MPU_HALT*
MPU_RESET*
MPU_CLK
MARKER_IN
MINX_IRQ*
PULSE_IRQ*
SCC_IRQ*
RTC_IRQ*

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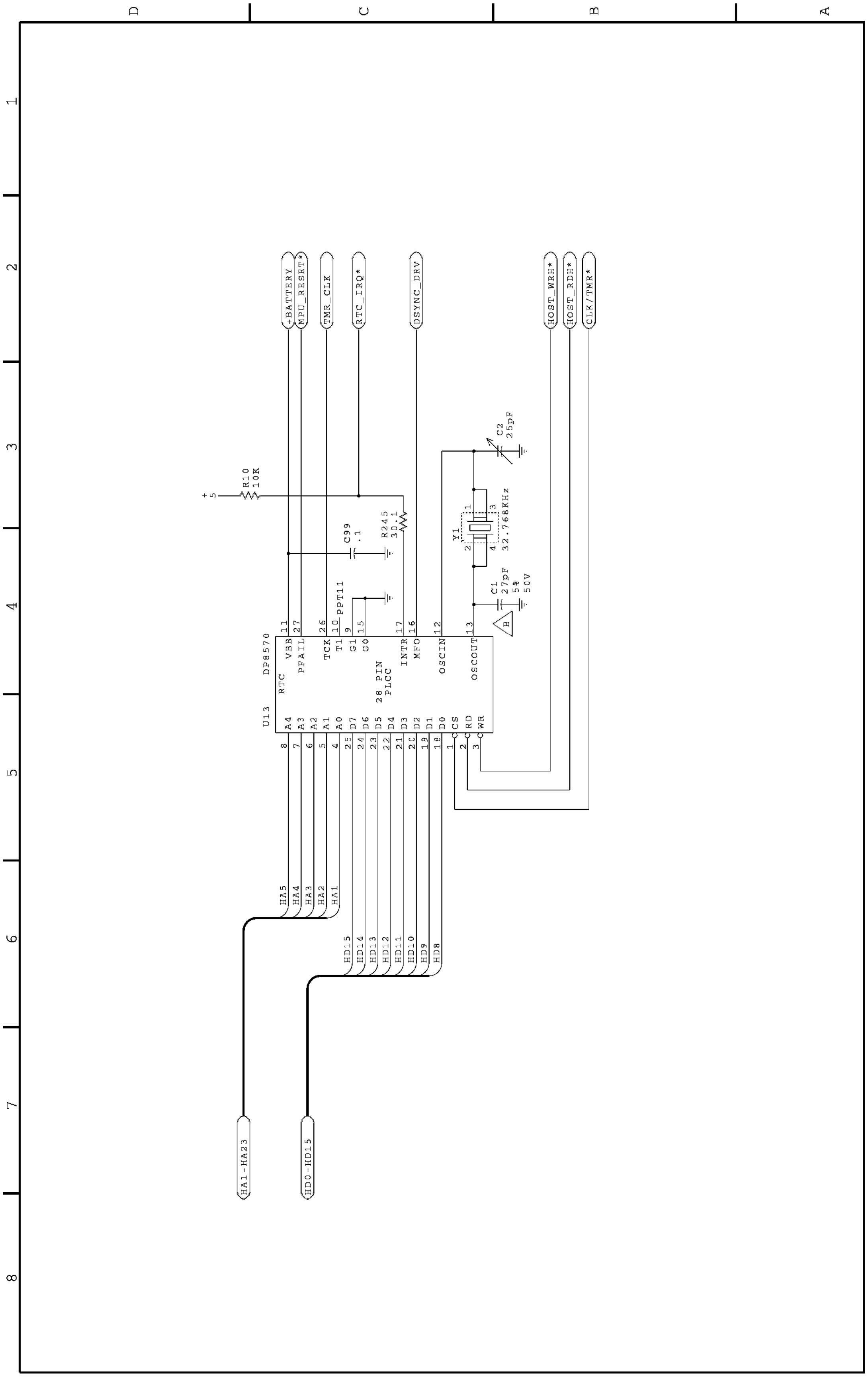
D
C
B
A
1
2
3
4
5
6
7
8
-BATTERY
MPU_RESET*
TMR_CLK
RTC_IRQ*
DSYNC_DRV
HOST_WRE*
HOST_RDE*
CLK/TMR*
+5
R10
10K
C99
.1
R245
30.1
C2
25pF
Y1
1
2
3
4
32.768KHz
C1
27pF
5%
50V
B
PPT11
U13
DP8570
RTC
28 PIN
PLCC
VBB 11
PFAIL 27
TCK 26
T1 10
G1 9
G0 15
INTR 17
MFO 16
OSCIN 12
OSCOUT 13
A4 8
A3 7
A2 6
A1 5
A0 4
D7 25
D6 24
D5 23
D4 22
D3 21
D2 20
D1 19
D0 18
CS 1
RD 2
WR 3
HA5
HA4
HA3
HA2
HA1
HD15
HD14
HD13
HD12
HD11
HD10
HD9
HD8
HA1-HA23
HD0-HD15

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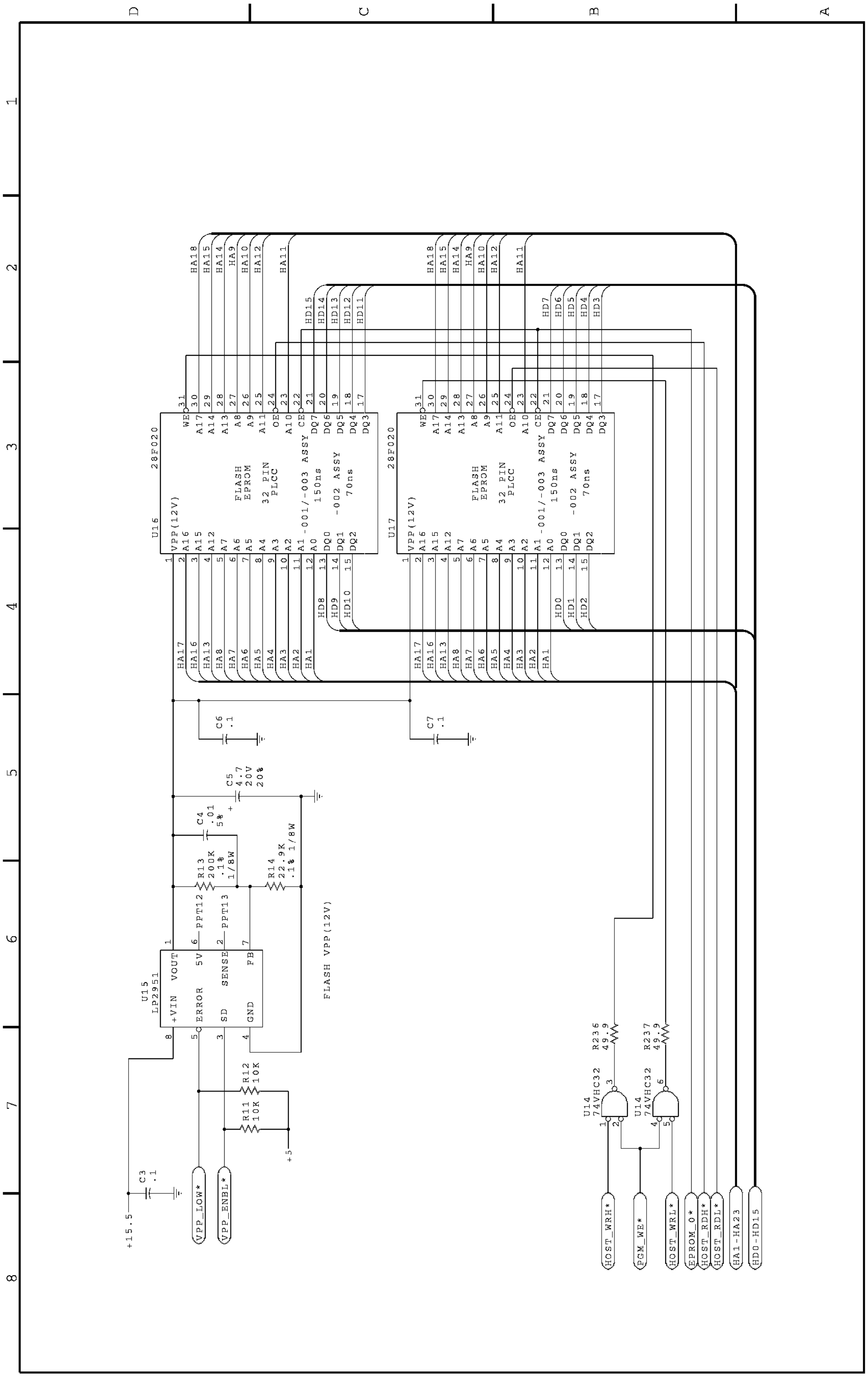
U16
28F020
FLASH EPROM
32 PIN PLCC
-001/-003 ASSY 150ns
-002 ASSY 70ns
U17
28F020
VPP(12V)
U15
LP2951
+VIN
VOUT
ERROR
5V
SD
SENSE
GND
FB
PPT12
PPT13
R13 200K .1% 1/8W
R14 22.9K .1% 1/8W
C4 .01 5%
C5 4.7 20V 20%
C6 .1
C7 .1
C3 .1
R11 10K
R12 10K
+5
+15.5
FLASH VPP(12V)
U14 74VHC32
R236 49.9
R237 49.9
VPP_LOW*
VPP_ENBL*
HOST_WRH*
PGM_WE*
HOST_WRL*
EPROM_0*
HOST_RDH*
HOST_RDL*
HA1-HA23
HD0-HD15
HA1
HA2
HA3
HA4
HA5
HA6
HA7
HA8
HA9
HA10
HA11
HA12
HA13
HA14
HA15
HA16
HA17
HA18
HD0
HD1
HD2
HD3
HD4
HD5
HD6
HD7
HD8
HD9
HD10
HD11
HD12
HD13
HD14
HD15
WE
OE
CE
A
B
C
D
1
2
3
4
5
6
7
8

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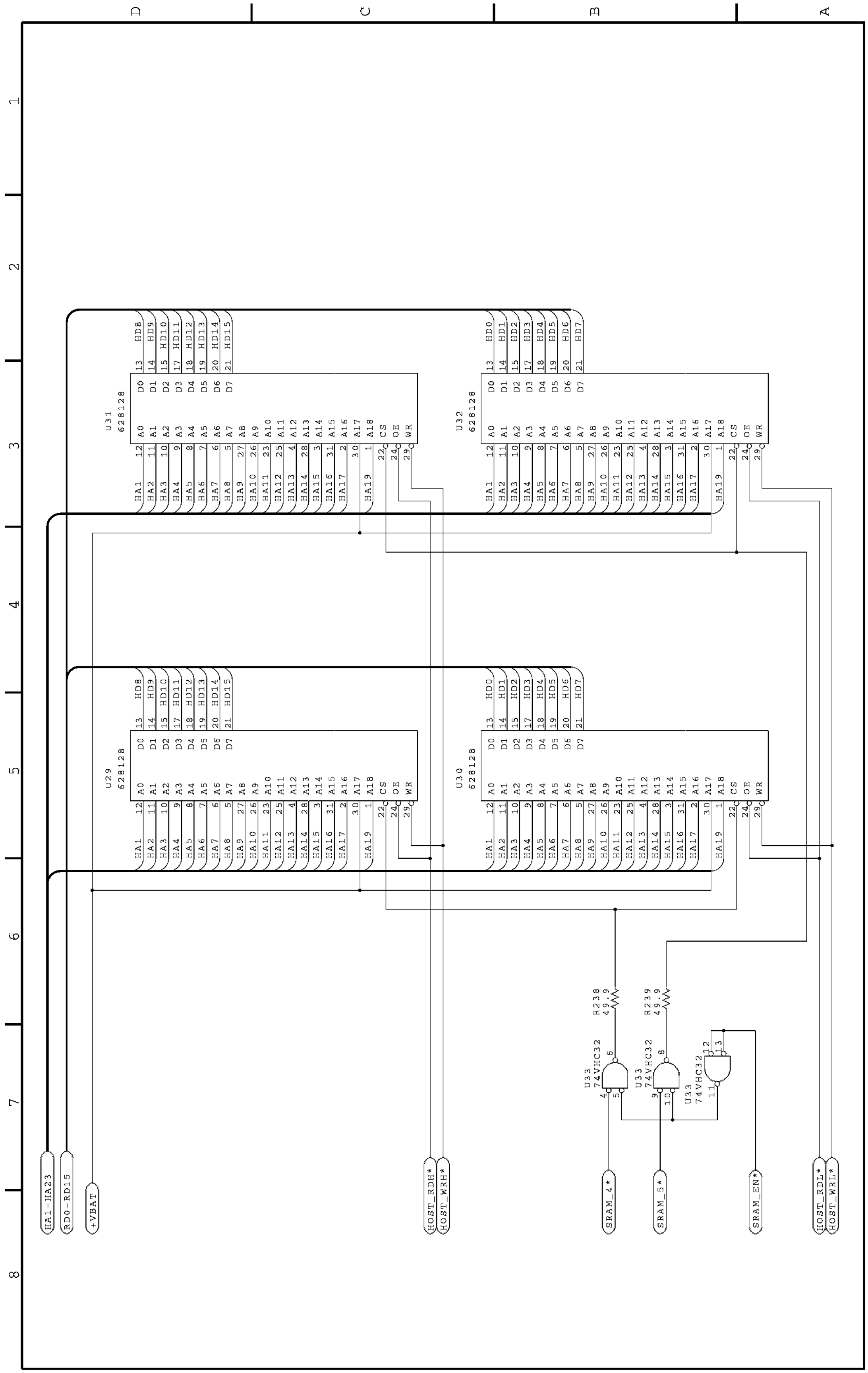
D
C
B
A
1
2
3
4
5
6
7
8
U31
628128
U32
628128
U29
628128
U30
628128
D0 D1 D2 D3 D4 D5 D6 D7
A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15 A16 A17 A18
CS
OE
WR
HD8 HD9 HD10 HD11 HD12 HD13 HD14 HD15
HD0 HD1 HD2 HD3 HD4 HD5 HD6 HD7
HA1 HA2 HA3 HA4 HA5 HA6 HA7 HA8 HA9 HA10 HA11 HA12 HA13 HA14 HA15 HA16 HA17 HA19
R238
49.9
R239
49.9
U33
74VHC32
U33
74VHC32
U33
74VHC32
HA1-HA23
RD0-RD15
+VBAT
HOST_RDH*
HOST_WRH*
SRAM_4*
SRAM_5*
SRAM_EN*
HOST_RDL*
HOST_WRL*

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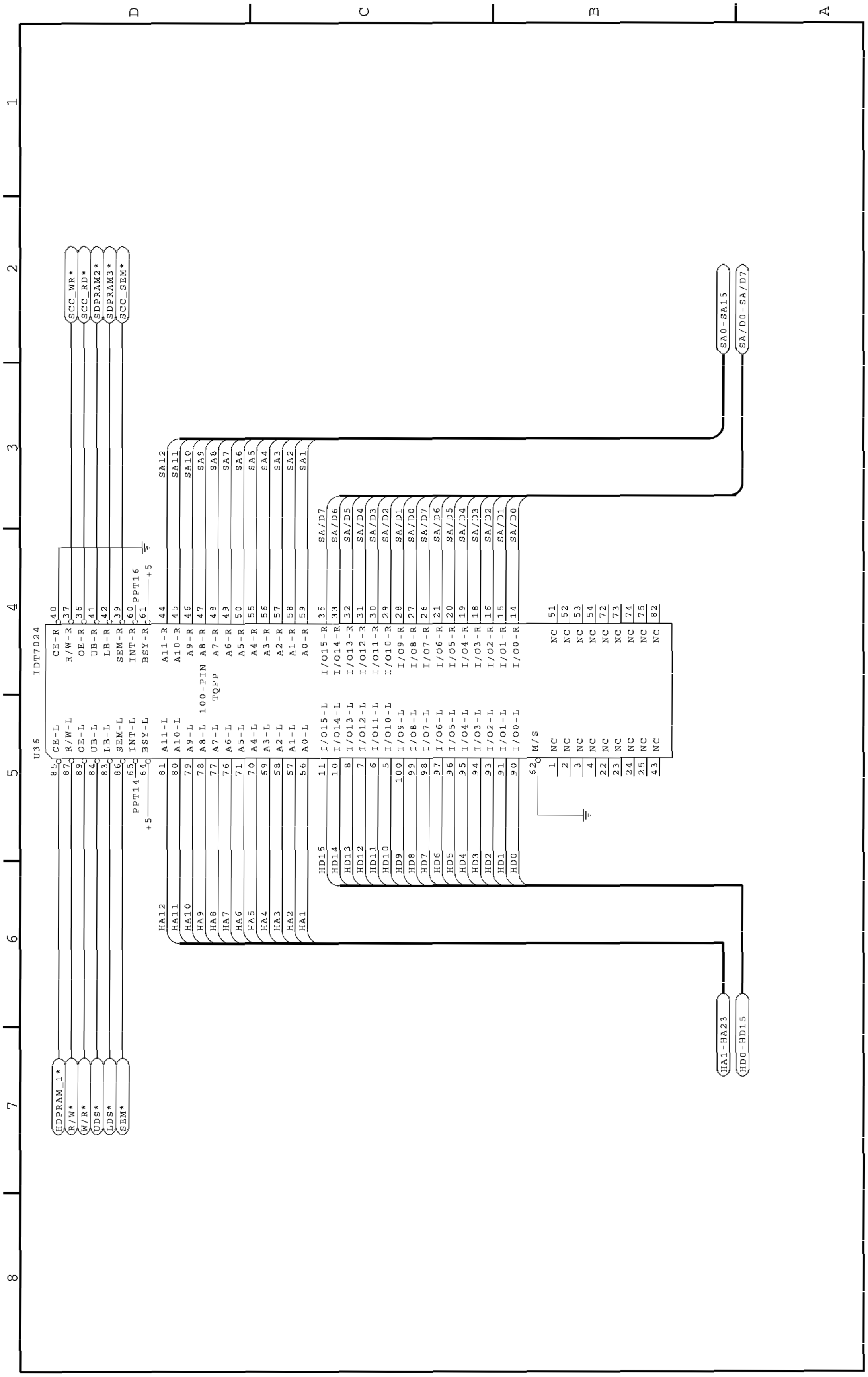
D
C
B
A
1
2
3
4
5
6
7
8
U36
IDT7024
100-PIN
TQFP
SCC_WR*
SCC_RD*
SDPRAM2*
SDPRAM3*
SCC_SEM*
HDPRAM_1*
R/W*
W/R*
UDS*
LDS*
SEM*
SA0-SA15
SA/D0-SA/D7
HA1-HA23
HD0-HD15
PPT16
PPT14
+5
CE-R
R/W-R
OE-R
UB-R
LB-R
SEM-R
INT-R
BSY-R
CE-L
R/W-L
OE-L
UB-L
LB-L
SEM-L
INT-L
BSY-L
A11-R
A10-R
A9-R
A8-R
A7-R
A6-R
A5-R
A4-R
A3-R
A2-R
A1-R
A0-R
A11-L
A10-L
A9-L
A8-L
A7-L
A6-L
A5-L
A4-L
A3-L
A2-L
A1-L
A0-L
I/O15-R
I/O14-R
I/O13-R
I/O12-R
I/O11-R
I/O10-R
I/O9-R
I/O8-R
I/O7-R
I/O6-R
I/O5-R
I/O4-R
I/O3-R
I/O2-R
I/O1-R
I/O0-R
I/O15-L
I/O14-L
I/O13-L
I/O12-L
I/O11-L
I/O10-L
I/O9-L
I/O8-L
I/O7-L
I/O6-L
I/O5-L
I/O4-L
I/O3-L
I/O2-L
I/O1-L
I/O0-L
M/S
NC
SA12
SA11
SA10
SA9
SA8
SA7
SA6
SA5
SA4
SA3
SA2
SA1
HA12
HA11
HA10
HA9
HA8
HA7
HA6
HA5
HA4
HA3
HA2
HA1
SA/D7
SA/D6
SA/D5
SA/D4
SA/D3
SA/D2
SA/D1
SA/D0
HD15
HD14
HD13
HD12
HD11
HD10
HD9
HD8
HD7
HD6
HD5
HD4
HD3
HD2
HD1
HD0

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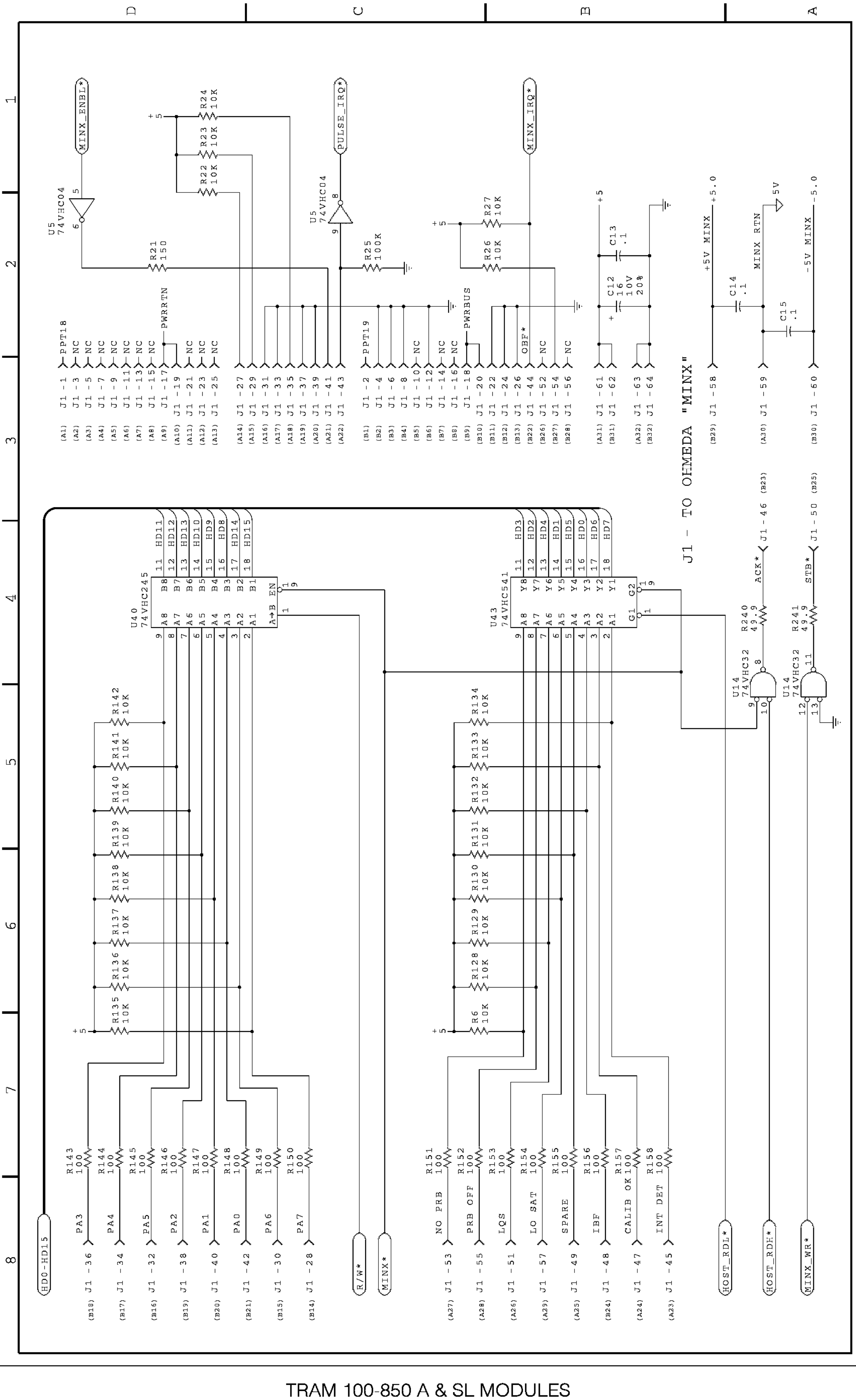
J1 - TO OHMEDA "MINX"
MINX_ENBL*
PULSE_IRQ*
MINX_IRQ*
U5 74VHC04
R21 150
R22 10K
R23 10K
R24 10K
R25 100K
R26 10K
R27 10K
C12 16 10V 20%
C13 .1
C14 .1
C15 .1
PWRRTN
PWRBUS
PPT18
PPT19
OBF*
NC
+5V MINX
+5.0
MINX RTN
5V
-5V MINX
-5.0
U40 74VHC245
U43 74VHC541
HD11 HD12 HD13 HD10 HD9 HD8 HD14 HD15
HD3 HD2 HD4 HD1 HD5 HD0 HD6 HD7
A→B EN
G1 G2
ACK*
STB*
R240 49.9
R241 49.9
U14 74VHC32
R135 R136 R137 R138 R139 R140 R141 R142 10K
R6 R128 R129 R130 R131 R132 R133 R134 10K
R143 R144 R145 R146 R147 R148 R149 R150 100
R151 R152 R153 R154 R155 R156 R157 R158 100
PA3 PA4 PA5 PA2 PA1 PA0 PA6 PA7
NO PRB
PRB OFF
LQS
LO SAT
SPARE
IBF
CALIB OK
INT DET
HD0-HD15
R/W*
MINX*
HOST_RDL*
HOST_RDH*
MINX_WR*
A B C D
1 2 3 4 5 6 7 8

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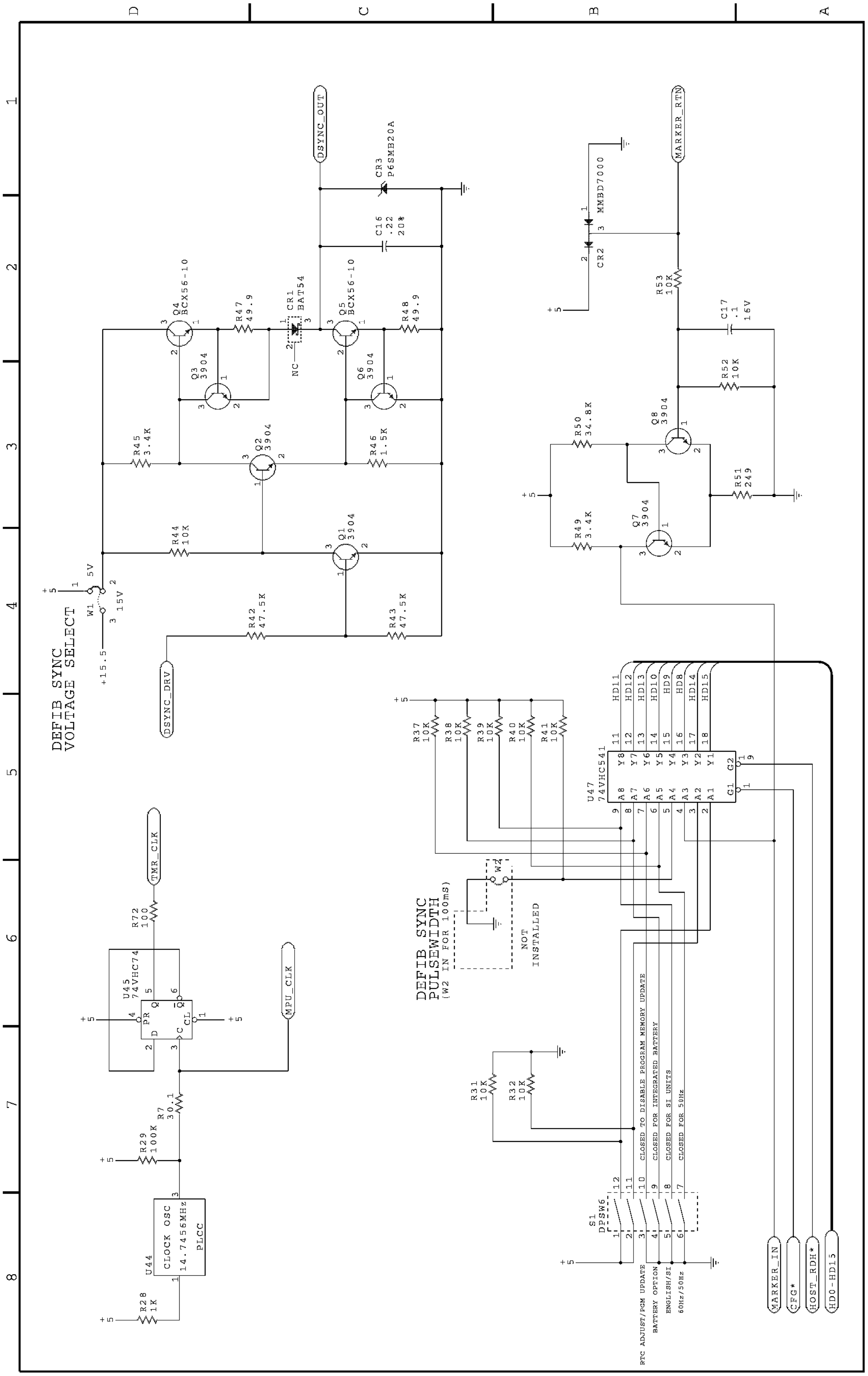
D
C
B
A
1
2
3
4
5
6
7
8
DSYNC_OUT
CR3
P6SMB20A
C16
.22
20%
Q4
BCX56-10
R47
49.9
CR1
BAT54
NC
Q5
BCX56-10
R48
49.9
Q3
3904
Q6
3904
R45
3.4K
Q2
3904
R46
1.5K
R44
10K
Q1
3904
W1
5V
15V
+15.5
+5
R42
47.5K
R43
47.5K
DSYNC_DRV
DEFIB SYNC
VOLTAGE SELECT
MARKER_RTN
MMBD7000
CR2
R53
10K
C17
.1
16V
R52
10K
R50
34.8K
Q8
3904
R51
249
R49
3.4K
Q7
3904
R37
10K
R38
10K
R39
10K
R40
10K
R41
10K
U47
74VHC541
HD11
HD12
HD13
HD10
HD9
HD8
HD14
HD15
W2
DEFIB SYNC
PULSEWIDTH
(W2 IN FOR 100mS)
NOT
INSTALLED
TMR_CLK
R72
100
U45
74VHC74
MPU_CLK
R7
30.1
R29
100K
U44
CLOCK OSC
14.7456MHz
PLCC
R28
1K
R31
10K
R32
10K
S1
DPSW6
CLOSED TO DISABLE PROGRAM MEMORY UPDATE
CLOSED FOR INTEGRATED BATTERY
CLOSED FOR SI UNITS
CLOSED FOR 50Hz
RTC ADJUST/PGM UPDATE
BATTERY OPTION
ENGLISH/SI
60Hz/50Hz
MARKER_IN
CFG*
HOST_RDH*
HD0-HD15

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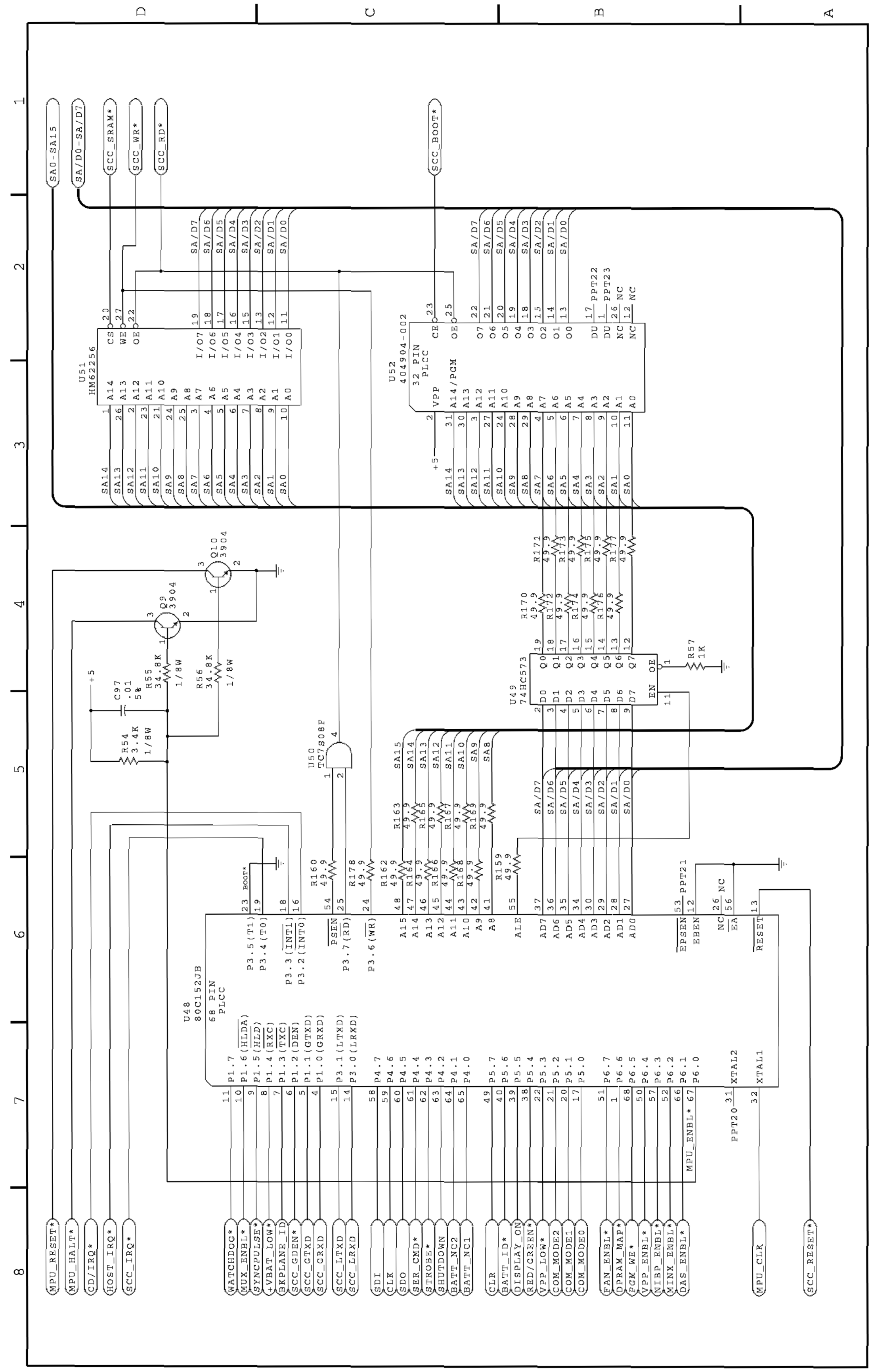
D
C
B
A
1
2
3
4
5
6
7
8
SA0-SA15
SA/D0-SA/D7
SCC_SRAM*
SCC_WR*
SCC_RD*
SCC_BOOT*
U51
HM62256
U52
404904-002
32 PIN
PLCC
U49
74HC573
U50
TC7S08F
U48
80C152JB
68 PIN
PLCC
Q9
3904
Q10
3904
R54
3.4K
1/8W
R55
34.8K
1/8W
R56
34.8K
1/8W
C97
.01
5%
R57
1K
R159
49.9
R160
49.9
R162
49.9
R163
49.9
R170
49.9
R171
49.9
R178
49.9
+5
PPT20
PPT21
PPT22
PPT23
NC
MPU_ENBL*
MPU_RESET*
MPU_HALT*
CD/IRQ*
HOST_IRQ*
SCC_IRQ*
WATCHDOG*
MUX_ENBL*
SYNCPULSE*
+VBAT_LOW*
BKPLANE_ID
SCC_GDEN*
SCC_GTXD
SCC_GRXD
SCC_LTXD
SCC_LRXD
SDI
CLK
SDO
SER_CMD*
STROBE*
SHUTDOWN
BATT_NC2
BATT_NC1
CLR
BATT_ID*
DISPLAY_ON
RED/GREEN*
VPP_LOW*
COM_MODE2
COM_MODE1
COM_MODE0
FAN_ENBL*
DPRAM_MAP*
PGM_WE*
VPP_ENBL*
NIBP_ENBL*
MINX_ENBL*
DAS_ENBL*
MPU_CLK
SCC_RESET*

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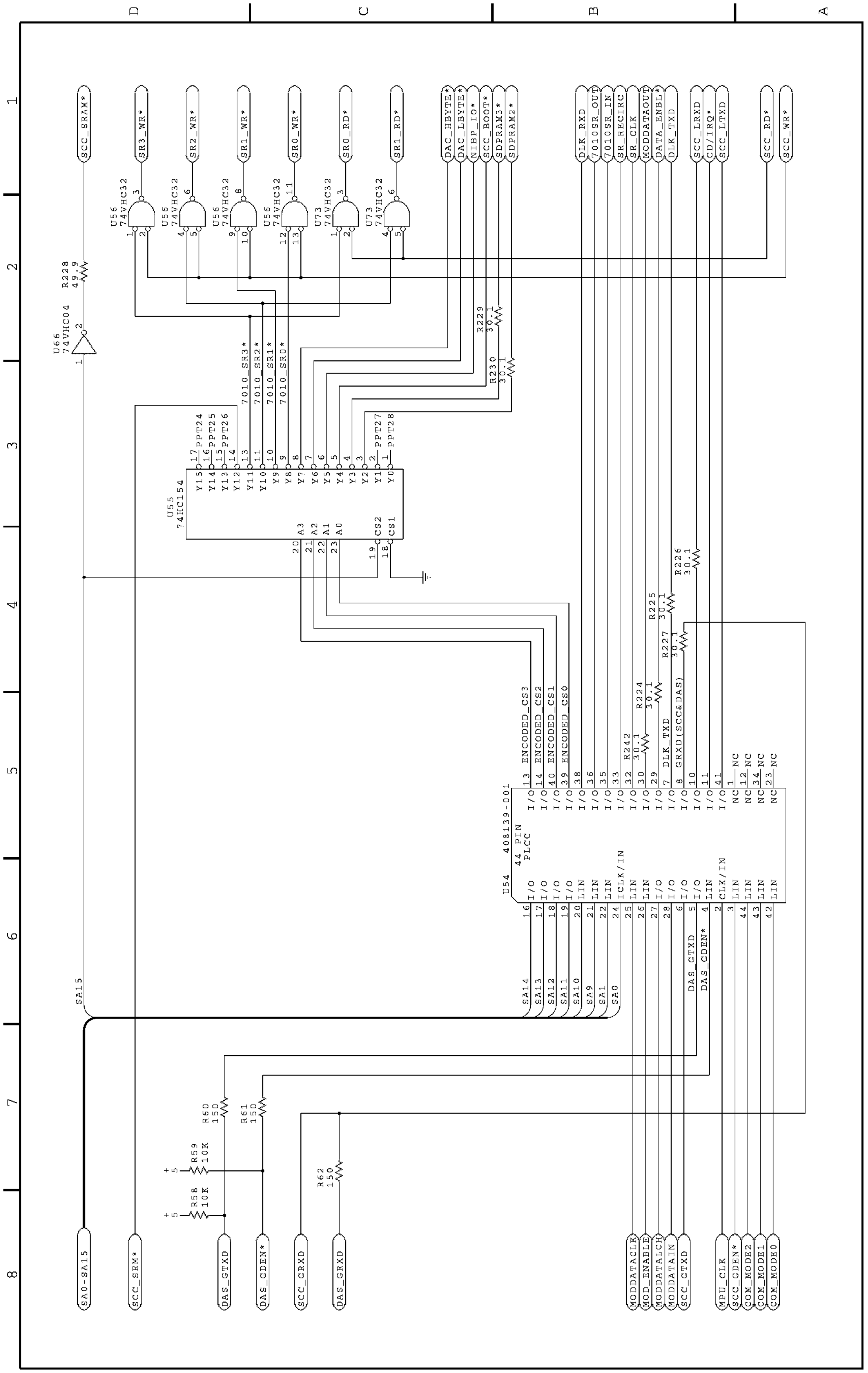

D
C
B
A
1
2
3
4
5
6
7
8
SCC_SRAM*
SR3_WR*
SR2_WR*
SR1_WR*
SR0_WR*
SR0_RD*
SR1_RD*
DAC_HBYTE*
DAC_LBYTE*
NIBP_IO*
SCC_BOOT*
SDPRAM3*
SDPRAM2*
DLK_RXD
7010SR_OUT
7010SR_IN
SR_RECIRC
SR_CLK
MODDATAOUT
DATA_ENBL*
DLK_TXD
SCC_LRXD
CD/IRQ*
SCC_LTXD
SCC_RD*
SCC_WR*
U56 74VHC32
U73 74VHC32
R228 49.9
U66 74VHC04
R229 30.1
R230 30.1
7010_SR3*
7010_SR2*
7010_SR1*
7010_SR0*
PPT24
PPT25
PPT26
PPT27
PPT28
U55 74HC154
Y15 Y14 Y13 Y12 Y11 Y10 Y9 Y8 Y7 Y6 Y5 Y4 Y3 Y2 Y1 Y0
A3 A2 A1 A0
CS2 CS1
R226 30.1
R225 30.1
R227 30.1
R224 30.1
R242 30.1
ENCODED_CS3
ENCODED_CS2
ENCODED_CS1
ENCODED_CS0
DLK_TXD
GRXD(SCC&DAS)
U54 408139-001 44 PIN PLCC
I/O
LIN
ICLK/IN
CLK/IN
NC
SA15
SA14
SA13
SA12
SA11
SA10
SA9
SA1
SA0
DAS_GTXD
DAS_GDEN*
R60 150
R61 150
R59 10K
R58 10K
R62 150
+5
SA0-SA15
SCC_SEM*
DAS_GTXD
DAS_GDEN*
SCC_GRXD
DAS_GRXD
MODDATACLK
MOD_ENABLE
MODDATALCH
MODDATAIN
SCC_GTXD
MPU_CLK
SCC_GDEN*
COM_MODE2
COM_MODE1
COM_MODE0

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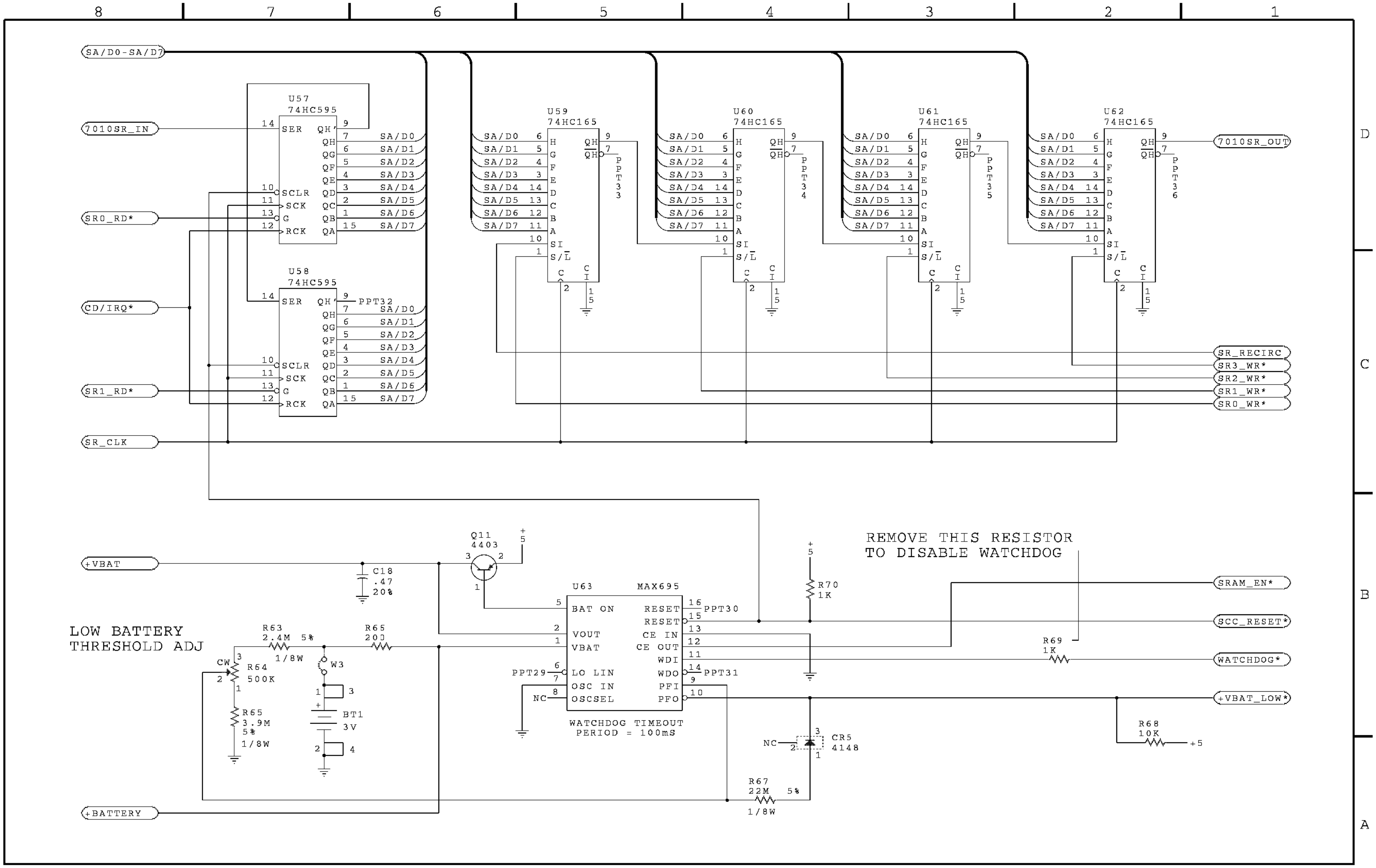
SA/D0-SA/D7
7010SR_IN
SR0_RD*
CD/IRQ*
SR1_RD*
SR_CLK
+VBAT
+BATTERY
U57
74HC595
U58
74HC595
PPT32
U59
74HC165
U60
74HC165
U61
74HC165
U62
74HC165
PPT33
PPT34
PPT35
PPT36
7010SR_OUT
SR_RECIRC
SR3_WR*
SR2_WR*
SR1_WR*
SR0_WR*
SRAM_EN*
SCC_RESET*
WATCHDOG*
+VBAT_LOW*
Q11
4403
U63
MAX695
BAT ON
VOUT
VBAT
LO LIN
OSC IN
OSCSEL
RESET
CE IN
CE OUT
WDI
WDO
PFI
PFO
PPT29
PPT30
PPT31
NC
WATCHDOG TIMEOUT
PERIOD = 100mS
REMOVE THIS RESISTOR
TO DISABLE WATCHDOG
C18
.47
20%
R70
1K
R69
1K
R68
10K
CR5
4148
R67
22M 5%
1/8W
LOW BATTERY
THRESHOLD ADJ
R63
2.4M 5%
1/8W
R64
500K
CW
R65
3.9M
5%
1/8W
R65
20J
W3
BT1
3V
+5
8
7
6
5
4
3
2
1
D
C
B
A

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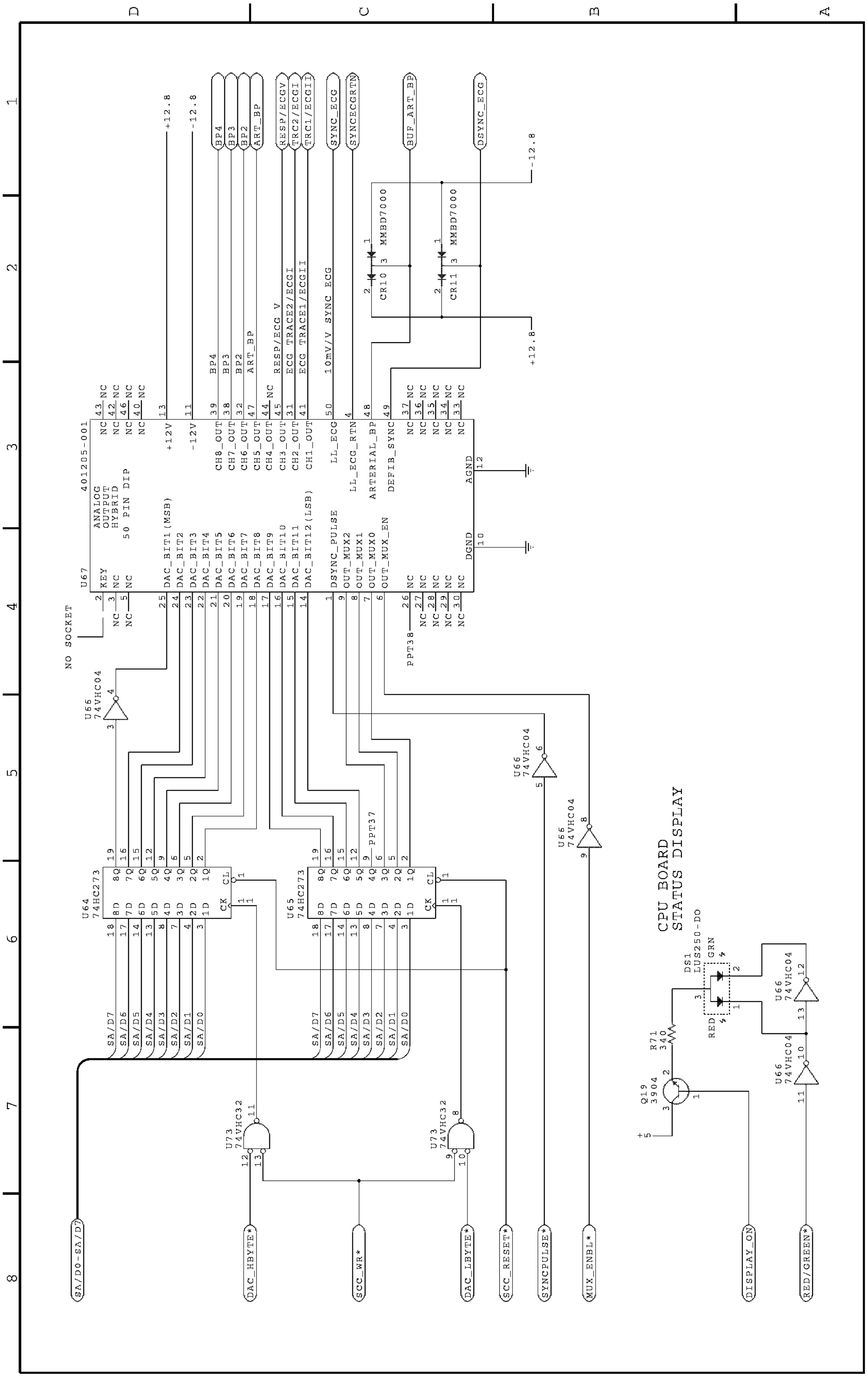
D
C
B
A
1
2
3
4
5
6
7
8
U67
401205-001
ANALOG
OUTPUT
HYBRID
50 PIN DIP
KEY
NO SOCKET
DAC_BIT1(MSB)
DAC_BIT2
DAC_BIT3
DAC_BIT4
DAC_BIT5
DAC_BIT6
DAC_BIT7
DAC_BIT8
DAC_BIT9
DAC_BIT10
DAC_BIT11
DAC_BIT12(LSB)
DSYNC_PULSE
OUT_MUX2
OUT_MUX1
OUT_MUX0
OUT_MUX_EN
DGND
AGND
+12V
-12V
CH8_OUT
CH7_OUT
CH6_OUT
CH5_OUT
CH4_OUT
CH3_OUT
CH2_OUT
CH1_OUT
LL_ECG
LL_ECG_RTN
ARTERIAL_BP
DEFIB_SYNC
NC
+12.8
-12.8
BP4
BP3
BP2
ART_BP
RESP/ECG V
ECG TRACE2/ECGI
ECG TRACE1/ECGII
10mV/V SYNC ECG
RESP/ECGV
TRC2/ECGI
TRC1/ECGII
SYNC_ECG
SYNCECGRTN
BUF_ART_BP
DSYNC_ECG
CR10
CR11
MMBD7000
PPT38
PPT37
U66
74VHC04
U64
74HC273
U65
74HC273
8D 7D 6D 5D 4D 3D 2D 1D
8Q 7Q 6Q 5Q 4Q 3Q 2Q 1Q
CK
CL
SA/D7
SA/D6
SA/D5
SA/D4
SA/D3
SA/D2
SA/D1
SA/D0
U73
74VHC32
CPU BOARD
STATUS DISPLAY
DS1
LUS250-DO
GRN
RED
R71
340
Q19
3904
+5
SA/D0-SA/D7
DAC_HBYTE*
SCC_WR*
DAC_LBYTE*
SCC_RESET*
SYNCPULSE*
MUX_ENBL*
DISPLAY_ON
RED/GREEN*

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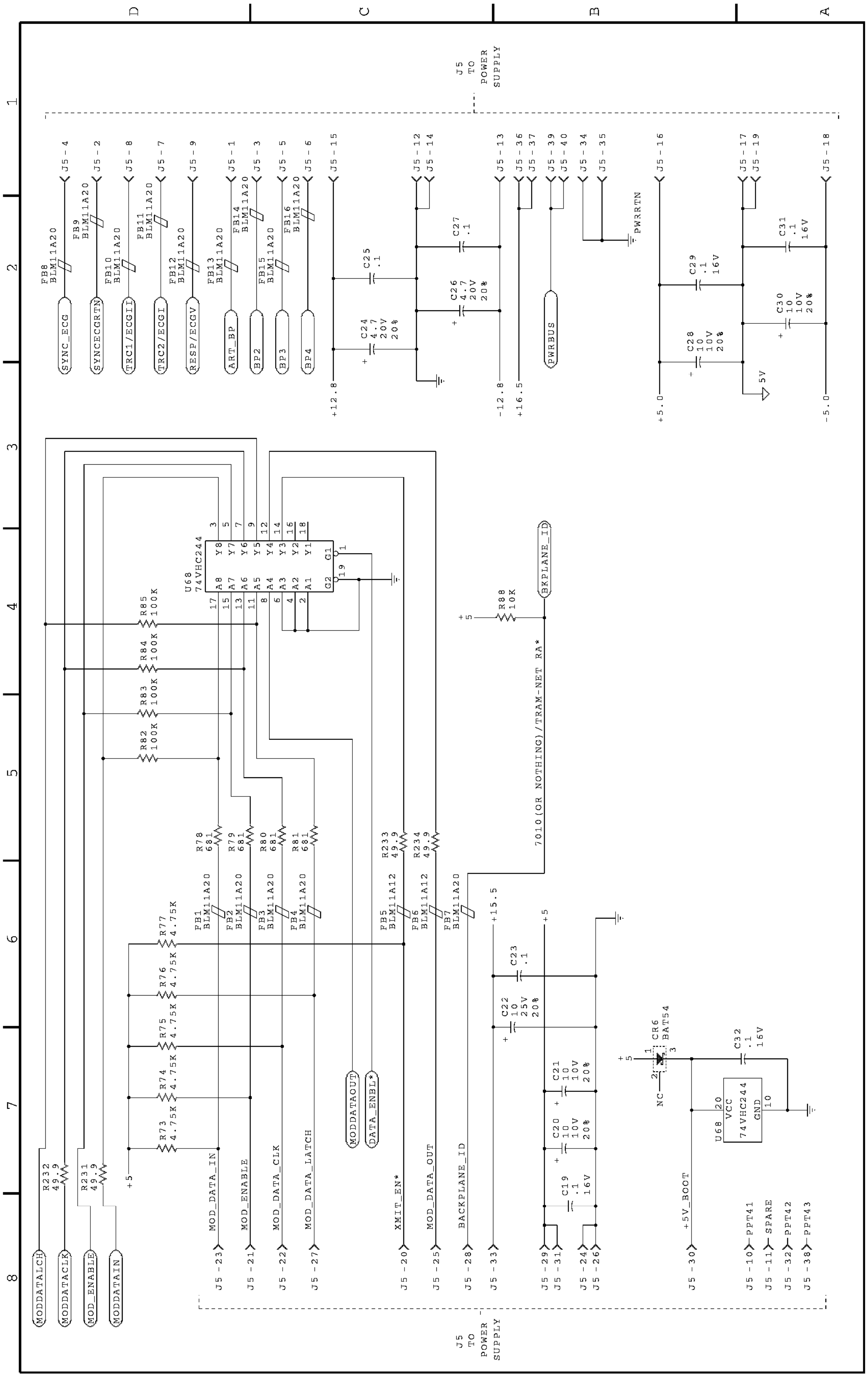
D
C
B
A
1
2
3
4
5
6
7
8
J5 TO POWER SUPPLY
J5-4
J5-2
J5-8
J5-7
J5-9
J5-1
J5-3
J5-5
J5-6
J5-15
J5-12
J5-14
J5-13
J5-36
J5-37
J5-39
J5-40
J5-34
J5-35
J5-16
J5-17
J5-19
J5-18
FB8 BLM11A20
FB9 BLM11A20
FB10 BLM11A20
FB11 BLM11A20
FB12 BLM11A20
FB13 BLM11A20
FB14 BLM11A20
FB15 BLM11A20
FB16 BLM11A20
SYNC_ECG
SYNCECGRTN
TRC1/ECGII
TRC2/ECGI
RESP/ECGV
ART_BP
BP2
BP3
BP4
C25 .1
C24 4.7 20V 20%
C27 .1
C26 4.7 20V 20%
+12.8
-12.8
+16.5
PWRBUS
PWRRTN
C29 .1 16V
C28 10 10V 20%
C31 .1 16V
C30 10 10V 20%
5V
+5.0
-5.0
U68 74VHC244
A8 A7 A6 A5 A4 A3 A2 A1 G2
Y8 Y7 Y6 Y5 Y4 Y3 Y2 Y1 G1
17 15 13 11 8 6 4 2 19
3 5 7 9 12 14 16 18 1
R85 100K
R84 100K
R83 100K
R82 100K
+5
R88 10K
BKPLANE_ID
7010(OR NOTHING)/TRAM-NET RA*
R78 681
R79 681
R80 681
R81 681
R233 49.9
R234 49.9
FB1 BLM11A20
FB2 BLM11A20
FB3 BLM11A20
FB4 BLM11A20
FB5 BLM11A12
FB6 BLM11A12
FB7 BLM11A20
R77 4.75K
R76 4.75K
R75 4.75K
R74 4.75K
R73 4.75K
+5
+15.5
+5
C23 .1
C22 10 25V 20%
C21 10 10V 20%
C20 10 10V 20%
C19 .1 16V
+5
CR6 BAT54
1 2 3
NC
C32 .1 16V
U68 74VHC244
VCC 20
GND 10
MODDATAOUT
DATA_ENBL*
R232 49.9
R231 49.9
MOD_DATA_IN
MOD_ENABLE
MOD_DATA_CLK
MOD_DATA_LATCH
XMIT_EN*
MOD_DATA_OUT
BACKPLANE_ID
+5V_BOOT
PPT41
SPARE
PPT42
PPT43
J5-23
J5-21
J5-22
J5-27
J5-20
J5-25
J5-28
J5-33
J5-29
J5-31
J5-24
J5-26
J5-30
J5-10
J5-11
J5-32
J5-38
MODDATALCH
MODDATACLK
MOD_ENABLE
MODDATAIN
J5 TO POWER SUPPLY

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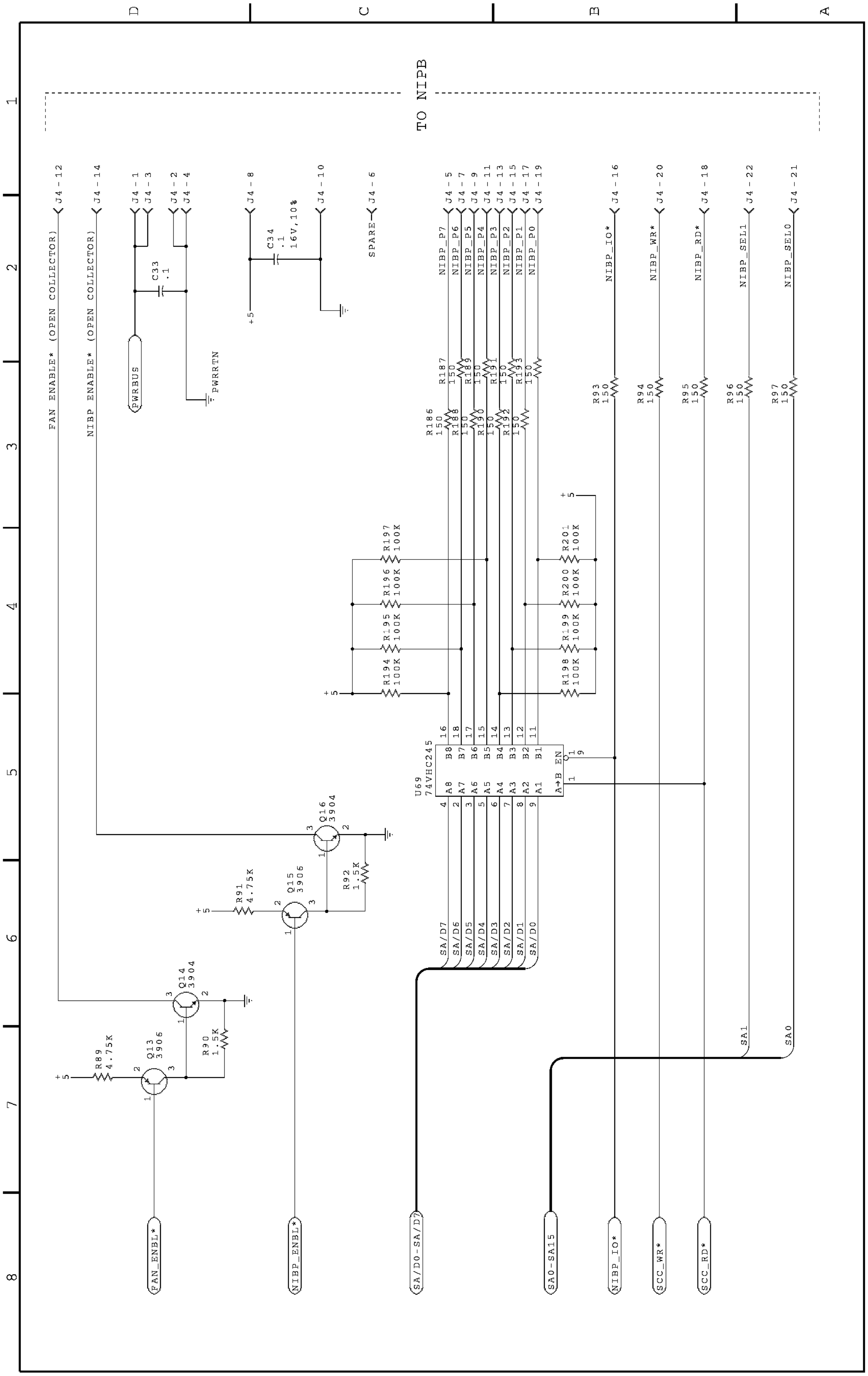
D
C
B
A
1
2
3
4
5
6
7
8
TO NIPB
J4-12
J4-14
J4-1
J4-3
J4-2
J4-4
J4-8
J4-10
J4-6
J4-5
J4-7
J4-9
J4-11
J4-13
J4-15
J4-17
J4-19
J4-16
J4-20
J4-18
J4-22
J4-21
FAN ENABLE* (OPEN COLLECTOR)
NIBP ENABLE* (OPEN COLLECTOR)
C33 .1
PWRBUS
PWRRTN
C34 .1 16V,10%
+5
SPARE
NIBP_P7
NIBP_P6
NIBP_P5
NIBP_P4
NIBP_P3
NIBP_P2
NIBP_P1
NIBP_P0
NIBP_IO*
NIBP_WR*
NIBP_RD*
NIBP_SEL1
NIBP_SEL0
R186 150
R187 150
R188 150
R189 150
R190 150
R191 150
R192 150
R193 150
R93 150
R94 150
R95 150
R96 150
R97 150
R197 100K
R196 100K
R195 100K
R194 100K
R201 100K
R200 100K
R199 100K
R198 100K
U69 74VHC245
A8 A7 A6 A5 A4 A3 A2 A1
B8 B7 B6 B5 B4 B3 B2 B1
EN
A→B
Q16 3904
Q15 3906
Q14 3904
Q13 3906
R92 1.5K
R91 4.75K
R90 1.5K
R89 4.75K
SA/D7
SA/D6
SA/D5
SA/D4
SA/D3
SA/D2
SA/D1
SA/D0
SA1
SA0
FAN_ENBL*
NIBP_ENBL*
SA/D0-SA/D7
SA0-SA15
NIBP_IO*
SCC_WR*
SCC_RD*

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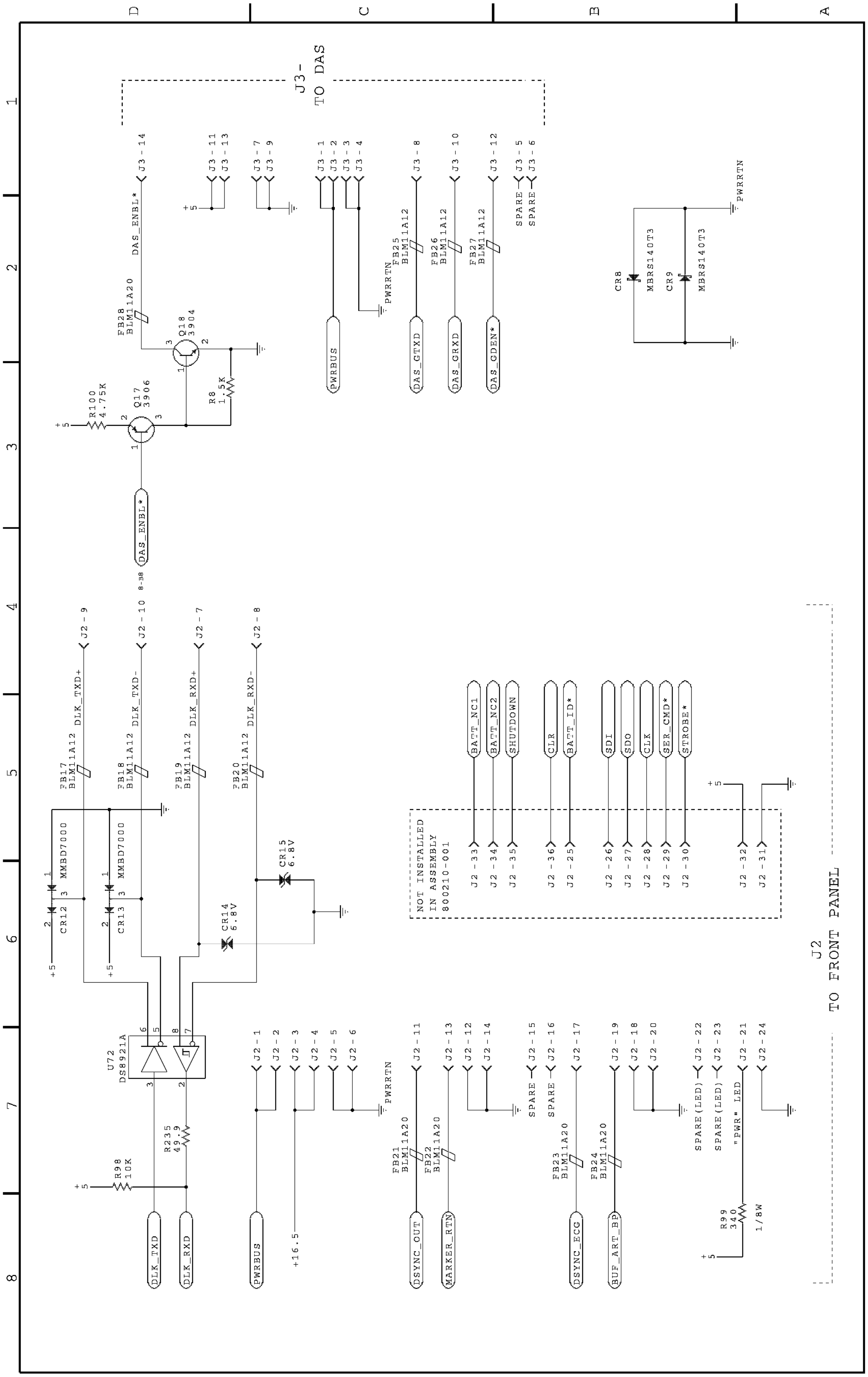
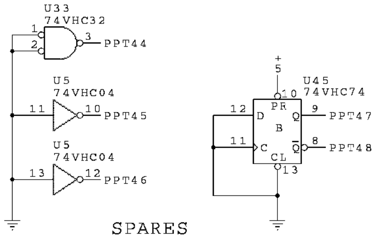

J3-
TO DAS
J3-14
DAS_ENBL*
FB28
BLM11A20
Q18
3904
Q17
3906
R100
4.75K
R8
1.5K
+5
DAS_ENBL*
J3-11
J3-13
J3-7
J3-9
J3-1
J3-2
J3-3
J3-4
PWRRTN
PWRBUS
J3-8
FB25
BLM11A12
DAS_GTXD
J3-10
FB26
BLM11A12
DAS_GRXD
J3-12
FB27
BLM11A12
DAS_GDEN*
SPARE J3-5
SPARE J3-6
CR8
MBRS140T3
CR9
MBRS140T3
PWRRTN
J2-9
DLK_TXD+
FB17
BLM11A12
J2-10
DLK_TXD-
FB18
BLM11A12
J2-7
DLK_RXD+
FB19
BLM11A12
J2-8
DLK_RXD-
FB20
BLM11A12
8-38
CR12
MMBD7000
CR13
MMBD7000
CR14
6.8V
CR15
6.8V
U72
DS8921A
R98
10K
R235
49.9
DLK_TXD
DLK_RXD
PWRBUS
+16.5
J2-1
J2-2
J2-3
J2-4
J2-5
J2-6
PWRRTN
J2-11
J2-13
J2-12
J2-14
FB21
BLM11A20
FB22
BLM11A20
DSYNC_OUT
MARKER_RTN
SPARE J2-15
SPARE J2-16
J2-17
FB23
BLM11A20
DSYNC_ECG
J2-19
J2-18
J2-20
FB24
BLM11A20
BUF_ART_BP
SPARE(LED) J2-22
SPARE(LED) J2-23
"PWR" LED J2-21
J2-24
R99
340
1/8W
NOT INSTALLED
IN ASSEMBLY
800210-001
BATT_NC1 J2-33
BATT_NC2 J2-34
SHUTDOWN J2-35
CLR J2-36
BATT_ID* J2-25
SDI J2-26
SDO J2-27
CLK J2-28
SER_CMD* J2-29
STROBE* J2-30
J2-32
J2-31
J2
TO FRONT PANEL
A
B
C
D
1
2
3
4
5
6
7
8

| IC POWER/RETURN CHART | | | | | | POWER SUPPLY | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IC | | POWER | | RETURN | | BYPASS | | | | | | | | | |
| U1 | 74VHC541 | 20 | +5 | 10 | | C35 | .1 | C103 | .001 * | | | | | | |
| U2 | 5AC312 | 1,28 | +5 | 14,15 | | C36 | .1 | C104 | .001 * | | | | | | |
| U3 | 68HC000 | 14&52 | +5 | 16,17,56,57 | | C38 | .1 | C105 | .001 * | C135 | .1 | C136 | .001 * | C129 | 1.0 16V |
| U4 | 5AC324 | 15,37 | +5 | 9,31 | | C40 | .1 | C106 | .001 * | C137 | .1 | C138 | .001 * | C130 | 1.0 16V |
| U5 | 74VHC04 | 14 | +5 | 7 | | C42 | .1 | C107 | .001 * | | | | | | |
| U6 | 74VHC32 | 14 | +5 | 7 | | C43 | .1 | C108 | .001 * | | | | | | |
| U13 | DP8570 | 28 | +5 | 14 | | C46 | .1 | C109 | .001 * | | | | | | |
| U14 | 74VHC32 | 14 | +5 | 7 | | C47 | .1 | C110 | .001 * | | | | | | |
| U16 | 28F020 -150nS | 32 | +5 | 16 | GND | C48 | .1 | C111 | .001 * | | | | | | |
| U17 | 28F020 -150nS | 32 | +5 | 16 | GND | C49 | .1 | C112 | .001 * | | | | | | |
| U29 | 628128L -120nS | 32 | +VBAT | 16 | GND | C61 | .1 | C113 | .001 * | C131 | 1.0 16V | | | | |
| U30 | 628128L -120nS | 32 | +VBAT | 16 | GND | C62 | .1 | C114 | .001 * | | | | | | |
| U31 | 628128L -120nS | 32 | +VBAT | 16 | GND | C63 | .1 | C115 | .001 * | | | | | | |
| U32 | 628128L -120nS | 32 | +VBAT | 16 | GND | C64 | .1 | C116 | .001 * | | | | | | |
| U33 | 74VHC32 | 14 | +VBAT | 7 | | C65 | .1 | C117 | .001 * | | | | | | |
| U36 | 7024LA | 12,17,88 | +5 | 9,13,34<br>38,63,92 | | C68 | .1 | C118 | .001 * | C132 | 1.0 16V | | | | |
| | | | | | | C69 | .1 | C119 | .001 * | | | | | | |
| U40 | 74VHC245 | 20 | +5 | 10 | | C70 | .1 | C120 | .001 * | | | | | | |
| U43 | 74VHC541 | 20 | +5 | 10 | | C71 | .1 | C121 | .001 * | | | | | | |
| U44 | CLK OSC 14.7456MHz | 4 | +5 | 2 | GND | C72 | .1 | C100 | .001 * | | | | | | |
| U45 | 74VHC74 | 14 | +5 | 7 | | C73 | .1 | C102 | .001 * | | | | | | |
| U47 | 74VHC541 | 20 | +5 | 10 | | C75 | .1 | C122 | .001 * | | | | | | |
| U48 | 80C152JB -1 | 2 | +5 | 3,33 | GND | C76 | .1 | C123 | .001 * | C133 | 1.0 16V | | | | |
| U49 | 74HC573 | 20 | +5 | 10 | | C77 | .1 | C124 | .001 * | | | | | | |
| U50 | TC7S08F | 5 | +5 | 3 | | C78 | .1 | C125 | .001 * | | | | | | |
| U51 | HM62256 -120 OR -150 | 28 | +5 | 14 | GND | C79 | .1 | C126 | .001 * | | | | | | |
| U52 | 27C256 -150nS | 32 | +5 | 16 | GND | C80 | .1 | C127 | .001 * | | | | | | |
| U54 | 5AC324 | 15,37 | +5 | 9,31 | | C81 | .1 | C82 | .001 * | C139 | .1 | C140 | .001 * | C134 | 1.0 16V |
| U55 | 74HC154 | 24 | +5 | 12 | | C83 | .1 | | | | | | | | |
| U56 | 74VHC32 | 14 | +5 | 7 | | C84 | .1 | | | | | | | | |
| U57 | 74HC595 | 16 | +5 | 8 | | C85 | .1 | | | | | | | | |
| U58 | 74HC595 | 16 | +5 | 8 | | C86 | .1 | | | | | | | | |
| U59 | 74HC165 | 16 | +5 | 8 | | C87 | .1 | | | | | | | | |
| U60 | 74HC165 | 16 | +5 | 8 | | C88 | .1 | | | | | | | | |
| U61 | 74HC165 | 16 | +5 | 8 | | C89 | .1 | | | | | | | | |
| U62 | 74HC165 | 16 | +5 | 8 | | C90 | .1 | | | | | | | | |
| U63 | MAX695 | 3 | +5 | 4 | | C91 | .1 | | | | | | | | |
| U64 | 74HC273 | 20 | +5 | 10 | | C92 | .1 | | | | | | | | |
| U65 | 74HC273 | 20 | +5 | 10 | | C93 | .1 | | | | | | | | |
| U66 | 74VHC04 | 14 | +5 | 7 | | C94 | .1 | | | | | | | | |
| U69 | 74VHC245 | 20 | +5 | 10 | | C95 | .1 | C128 | .001 * | | | | | | |
| U72 | DS8921A | 1 | +5 | 4 | | C96 | .1 | | | | | | | | |
| U73 | 74VHC32 | 14 | +5 | 7 | | C98 | .1 | | | | | | | | |

*=5%,50V



| LABEL | PAGE COORDINATES |
|---|---|
| +12.8: | 11-B3,D1<br>12-C3 |
| +15.5: | 3-D8<br>7-D4<br>12-C6 |
| +16.5: | 12-B3<br>14-C8 |
| +5.0: | 6-B2<br>12-B3 |
| +BATTERY: | 2-C2<br>10-A8 |
| +VBAT: | 4-D8<br>10-B8 |
| +VBAT_LOW*: | 8-C8<br>10-B1 |
| -12.8: | 11-B1,D1<br>12-B3 |
| -5.0: | 6-A2<br>12-A3 |
| 7010SR_IN: | 9-B1<br>10-D8 |
| 7010SR_OUT: | 9-B1<br>10-D1 |
| ART_BP: | 11-C1<br>12-D3 |
| AS*: | 1-B3,B6,C3 |
| BATT_ID*: | 8-B8<br>14-B5 |
| BATT_NC1: | 8-C8<br>14-C5 |
| BATT_NC2: | 8-C8<br>14-C5 |
| BERR*: | 1-C3,C6 |
| BKPLANE_ID: | 8-C8<br>12-B4 |
| BP2: | 11-D1<br>12-C3 |
| BP3: | 11-D1<br>12-C3 |
| BP4: | 11-D1<br>12-C3 |
| BUF_ART_BP: | 11-C1<br>14-B8 |
| CD/IRQ*: | 8-D8<br>9-B1<br>10-C8 |
| CFG*: | 1-D1<br>7-A8 |
| CLK: | 8-C8<br>14-B5 |
| CLK/TMR*: | 1-C1<br>2-B2 |
| CLR: | 8-C8<br>14-B5 |
| COM_MODE0: | 8-B8<br>9-A8 |
| COM_MODE1: | 8-B8<br>9-A8 |
| COM_MODE2: | 8-B8<br>9-A8 |
| DAC_HBYTE*: | 9-C1<br>11-D8 |
| DAC_LBYTE*: | 9-C1<br>11-C8 |
| DAS_ENBL*: | 8-B8<br>14-D4 |
| DAS_GDEN*: | 9-C8<br>14-C3 |
| DAS_GRXD: | 9-C8<br>14-C3 |
| DAS_GTXD: | 9-D8<br>14-C3 |
| DATA_ENBL*: | 9-B1<br>12-C7 |
| DISPLAY_ON: | 8-B8<br>11-A8 |
| DLK_RXD: | 9-B1<br>14-D8 |
| DLK_TXD: | 9-B1<br>14-D8 |
| DPRAM_MAP*: | 1-C1<br>8-B8 |
| DSYNC_DRV: | 2-C2<br>7-D5 |
| DSYNC_ECG: | 11-C1<br>14-B8 |
| DSYNC_OUT: | 7-C1<br>14-C8 |
| DTACK*: | 1-C3,C6 |
| EPROM_0*: | 1-C1<br>3-B8 |
| FAN_ENBL*: | 8-B8<br>13-D8 |
| FC0: | 1-A6,B6 |
| FC1: | 1-A6,B6 |
| FC2: | 1-A6,B6 |
| HA1: | 1-B6,C4,C7<br>2-C6<br>3-B4,C4<br>4-C3,C5,D3,D5<br>5-C6 |
| HA2: | 1-B6,C4,C7<br>2-C6<br>3-B4,C4<br>4-B3,B5,D3,D5<br>5-C6 |
| HA3: | 1-B6,C4,C7<br>2-C6<br>3-B4,C4<br>4-B3,B5,D3,D5<br>5-C6 |
| HA4: | 1-C4<br>2-C6<br>3-B4,C4<br>4-B3,B5,D3,D5<br>5-C6 |
| HA5: | 1-C4<br>2-C6<br>3-C4<br>4-B3,B5,D3,D5<br>5-D6 |
| HA6: | 1-C4<br>3-C4,D4<br>4-B3,B5,D3,D5<br>5-D6 |
| HA7: | 1-C4<br>3-C4,D4<br>4-B3,B5,D3,D5<br>5-D6 |
| HA8: | 1-C4<br>3-C4,D4<br>4-B3,B5,D3,D5<br>5-D6 |
| HA9: | 1-C4<br>3-C2,D2<br>4-B3,B5,D3,D5<br>5-D6 |
| HA10: | 1-C4<br>3-C2,D2<br>4-B3,B5,D3,D5<br>5-D6 |
| HA11: | 1-C4<br>3-B2,C2<br>4-B3,B5,C3,C5<br>5-D6 |
| HA12: | 1-C4<br>3-C2<br>4-B3,B5,C3,C5<br>5-D6 |
| HA13: | 1-C4<br>3-C4,D4<br>4-B3,B5,C3,C5 |
| HA14: | 1-C4<br>3-C2,D2<br>4-B3,B5,C3,C5 |
| HA15: | 1-C4<br>3-C2,D2<br>4-B3,B5,C3,C5 |
| HA16: | 1-C4<br>3-C4,D4<br>4-B3,B5,C3,C5 |
| HA17: | 1-D4<br>3-C4,D4<br>4-B3,B5,C3,C5 |
| HA18: | 1-D4<br>3-C2,D2 |
| HA19: | 1-D4<br>4-B3,B5,C3,C5 |
| HA20: | 1-D4 |
| HA21: | 1-D4 |
| HA22: | 1-D4 |
| HA23: | 1-D4 |
| HA1-HA23: | 1-D8<br>2-D8<br>3-B8<br>4-D8<br>5-B7 |
| HD0: | 1-B3,C6<br>3-B4<br>4-C2,C5<br>5-B6<br>6-B4 |
| HD0-HD15: | 1-D8<br>2-C8<br>3-A8<br>5-A7<br>6-D8<br>7-A8 |
| HD1: | 1-B3,C6<br>3-B4<br>4-B2,B5<br>5-B6<br>6-B4 |
| HD2: | 1-B3,C6<br>3-B4<br>4-B2,B5<br>5-C6<br>6-B4 |

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| LABEL | PAGE COORDINATES |
|---|---|
| HD3: | 1-B3,C6<br>3-B2<br>4-B2,B5<br>5-C6<br>6-B4 |
| HD4: | 1-B3,C6<br>3-B2<br>4-B2,B5<br>5-C6<br>6-B4 |
| HD5: | 1-B3,C6<br>3-B2<br>4-B2,B5<br>5-C6<br>6-B4 |
| HD6: | 1-B3,C6<br>3-B2<br>4-B2,B5<br>5-C6<br>6-B4 |
| HD7: | 1-B3,C6<br>3-B2<br>4-B2,B5<br>5-C6<br>6-B4 |
| HD8: | 1-B3<br>2-C6<br>3-C4<br>4-D2,D5<br>5-C6<br>6-D4<br>7-B4 |
| HD9: | 1-B3<br>2-C6<br>3-C4<br>4-D2,D5<br>5-C6<br>6-D4<br>7-B4 |
| HD10: | 1-B4<br>2-C6<br>3-C4<br>4-D2,D5<br>5-C6<br>6-D4<br>7-B5 |
| HD11: | 1-B4<br>2-C6<br>3-C2<br>4-D2,D5<br>5-C6<br>6-D4<br>7-B5 |
| HD12: | 1-B4<br>2-C6<br>3-C2<br>4-D2,D5<br>5-C6<br>6-D4<br>7-B5 |
| HD13: | 1-B4<br>2-C6<br>3-C2<br>4-D2,D5<br>5-C6<br>6-D4<br>7-B5 |
| HD14: | 1-C4<br>2-C6<br>3-C2<br>4-D2,D5<br>5-C6<br>6-D4<br>7-B5 |
| HD15: | 1-C4<br>2-C6<br>3-C2<br>4-D2,D5<br>5-C6<br>6-D4<br>7-B5 |
| HDPRAM_1*: | 1-D1<br>5-D7 |
| HOST_IRQ*: | 1-B1<br>8-D8 |
| HOST_RDH*: | 1-B1<br>2-B2<br>3-B8<br>4-C8<br>6-A8<br>7-A8 |
| HOST_RDL*: | 1-A1<br>3-B8<br>4-A8<br>6-B8 |
| HOST_WRH*: | 1-B1<br>2-B2<br>3-B8<br>4-C8 |
| HOST_WRL*: | 1-B1<br>3-B8<br>4-A8 |
| IPL0: | 1-A3,B6 |
| IPL1: | 1-A3,B6 |
| IPL2: | 1-A3,B6 |
| LDS*: | 1-A1,A3,B3,B6<br>5-D7 |
| MARKER_IN: | 1-B8<br>7-A8 |
| MARKER_RTN: | 7-B1<br>14-C8 |
| MINX*: | 1-C1<br>6-C8 |
| MINX_ENBL*: | 6-D1<br>8-B8 |
| MINX_IRQ*: | 1-B8<br>6-B1 |
| MINX_WR*: | 1-C1<br>6-A8 |
| MODDATACLK: | 9-B8<br>12-D8 |
| MODDATAIN: | 9-B8<br>12-D8 |
| MODDATALCH: | 9-B8<br>12-D8 |
| MODDATAOUT: | 9-B1<br>12-C7 |
| MOD_ENABLE: | 9-B8<br>12-D8 |
| MPU_CLK: | 1-C8<br>7-C6<br>8-A8<br>9-B8 |
| MPU_HALT*: | 1-D8<br>8-D8 |
| MPU_RESET*: | 1-D8<br>2-C2<br>8-D8 |
| MUX_ENBL*: | 8-D8<br>11-B8 |
| NIBP_ENBL*: | 8-B8<br>13-C8 |
| NIBP_IO*: | 9-C1<br>13-B8 |
| PGM_WE*: | 3-B8<br>8-B8 |
| PPT1: | 1-B5 |
| PPT2: | 1-B5 |
| PPT3: | 1-B5 |
| PPT5: | 1-D2 |
| PPT6: | 1-C2 |
| PPT7: | 1-C2 |
| PPT8: | 1-C2 |
| PPT9: | 1-C2 |
| PPT10: | 1-C2 |
| PPT11: | 2-C4 |
| PPT12: | 3-D6 |
| PPT13: | 3-D6 |
| PPT14: | 5-D5 |
| PPT16: | 5-D4 |
| PPT18: | 6-D2 |
| PPT19: | 6-C2 |
| PPT20: | 8-B7 |
| PPT21: | 8-B6 |
| PPT22: | 8-B2 |
| PPT23: | 8-B2 |
| PPT24: | 9-D3 |
| PPT25: | 9-D3 |
| PPT26: | 9-D3 |
| PPT27: | 9-C3 |
| PPT28: | 9-C3 |
| PPT29: | 10-B6 |
| PPT30: | 10-B4 |
| PPT31: | 10-B4 |
| PPT32: | 10-C6 |
| PPT33: | 10-D5 |
| PPT34: | 10-D4 |
| PPT35: | 10-D3 |
| PPT36: | 10-D2 |
| PPT37: | 11-C5 |
| PPT38: | 11-C4 |
| PPT41: | 12-A8 |
| PPT42: | 12-A8 |
| PPT43: | 12-A8 |
| PPT44: | 15-B2 |
| PPT45: | 15-B2 |
| PPT46: | 15-A2 |
| PPT47: | 15-B1 |
| PPT48: | 15-B1 |
| PULSE_IRQ*: | 1-B8<br>6-C1 |
| PWRBUS: | 6-C2<br>12-B3<br>13-D3<br>14-C3,C8 |
| PWRRTN: | 6-D2 |

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| LABEL | PAGE COORDINATES |
|---|---|
| R/W*: | 1-A1,A3,B3,C3<br>5-D7<br>6-C8 |
| RD0-RD15: | 4-D8 |
| RED/GREEN*: | 8-B8<br>11-A8 |
| RESP/ECGV: | 11-C1<br>12-D3 |
| RTC_IRQ*: | 1-B8<br>2-C2 |
| SA/D0: | 5-B4,C4<br>8-B2,B5,C2<br>10-C6,D2,D3,D5,D6<br>11-C7,D7<br>13-B6 |
| SA/D0-SA/D7: | 5-A2<br>8-D1<br>10-D8<br>11-D8<br>13-C8 |
| SA/D1: | 5-B4,C4<br>8-B2,B5,C2<br>10-C6,D2,D3,D5,D6<br>11-C7,D7<br>13-B6 |
| SA/D2: | 5-C4<br>8-B2,B5,D2<br>10-C6,D2,D3,D5,D6<br>11-C7,D7<br>13-B6 |
| SA/D3: | 5-C4<br>8-B2,B5,D2<br>10-C6,D2,D3,D5,D6<br>11-C7,D7<br>13-C6 |
| SA/D4: | 5-C4<br>8-B2,B5,D2<br>10-C6,D2,D3,D5,D6<br>11-C7,D7<br>13-C6 |
| SA/D5: | 5-C4<br>8-B5,C2,D2<br>10-C6,D2,D3,D5,D6<br>11-C7,D7<br>13-C6 |
| SA/D6: | 5-C4<br>8-B5,C2,D2<br>10-C6,D2,D3,D5,D6<br>11-C7,D7<br>13-C6 |

| LABEL | PAGE COORDINATES |
|---|---|
| SA/D7: | 5-C4<br>8-B5,C2,D2<br>10-C6,D2,D3,D5,D6<br>11-C7,D7<br>13-C6 |
| SA0: | 8-B3,C3<br>9-B6<br>13-A7 |
| SA0-SA15: | 5-B2<br>8-D1<br>9-D8<br>13-B8 |
| SA1: | 5-C3<br>8-B3,C3<br>9-B6<br>13-A7 |
| SA2: | 5-C3<br>8-B3,D3 |
| SA3: | 5-C3<br>8-B3,D3 |
| SA4: | 5-C3<br>8-B3,D3 |
| SA5: | 5-D3<br>8-B3,D3 |
| SA6: | 5-D3<br>8-B3,D3 |
| SA7: | 5-D3<br>8-B3,D3 |
| SA8: | 5-D3<br>8-B3,C5,D3 |
| SA9: | 5-D3<br>8-B3,C5,D3<br>9-B6 |
| SA10: | 5-D3<br>8-C3,C5,D3<br>9-B6 |
| SA11: | 5-D3<br>8-C3,C5,D3<br>9-B6 |
| SA12: | 5-D3<br>8-C3,C5,D3<br>9-B6 |
| SA13: | 8-C3,C5,D3<br>9-B6 |
| SA14: | 8-C3,C5,D3<br>9-B6 |
| SA15: | 8-C5<br>9-D6 |
| SCC_BOOT*: | 8-C1<br>9-C1 |

| LABEL | PAGE COORDINATES |
|---|---|
| SCC_GDEN*: | 8-C8<br>9-B8 |
| SCC_GRXD: | 8-C8<br>9-C8 |
| SCC_GTXD: | 8-C8<br>9-B8 |
| SCC_IRQ*: | 1-B8<br>8-D8 |
| SCC_LRXD: | 8-C8<br>9-B1 |
| SCC_LTXD: | 8-C8<br>9-B1 |
| SCC_RD*: | 5-D2<br>8-D1<br>9-A1<br>13-B8 |
| SCC_RESET*: | 8-A8<br>10-B1<br>11-B8 |
| SCC_SEM*: | 5-D2<br>9-D8 |
| SCC_SRAM*: | 8-D1<br>9-D1 |
| SCC_WR*: | 5-D2<br>8-D1<br>9-A1<br>11-C8<br>13-B8 |
| SDI: | 8-C8<br>14-B5 |
| SDO: | 8-C8<br>14-B5 |
| SDPRAM2*: | 5-D2<br>9-B1 |
| SDPRAM3*: | 5-D2<br>9-B1 |
| SEM*: | 1-D1<br>5-D7 |
| SER_CMD*: | 8-C8<br>14-B5 |
| SHUTDOWN: | 8-C8<br>14-B5 |
| SR0_RD*: | 9-C1<br>10-D8 |
| SR0_WR*: | 9-C1<br>10-C1 |
| SR1_RD*: | 9-C1<br>10-C8 |
| SR1_WR*: | 9-D1<br>10-C1 |

| LABEL | PAGE COORDINATES |
|---|---|
| SR2_WR*: | 9-D1<br>10-C1 |
| SR3_WR*: | 9-D1<br>10-C1 |
| SRAM_4*: | 1-D1<br>4-B8 |
| SRAM_5*: | 1-D1<br>4-B8 |
| SRAM_EN*: | 4-A8<br>10-B1 |
| SR_CLK: | 9-B1<br>10-C8 |
| SR_RECIRC: | 9-B1<br>10-C1 |
| STROBE*: | 8-C8<br>14-B5 |
| SYNCECGRTN: | 11-C1<br>12-D3 |
| SYNCPULSE*: | 8-D8<br>11-B8 |
| SYNC_ECG: | 11-C1<br>12-D3 |
| TMR_CLK: | 2-C2<br>7-D6 |
| TRC1/ECGII: | 11-C1<br>12-D3 |
| TRC2/ECGI: | 11-C1<br>12-D3 |
| UDS*: | 1-A1,A3,B3,C3<br>5-D7 |
| VPP_ENBL*: | 3-D8<br>8-B8 |
| VPP_LOW*: | 3-D8<br>8-B8 |
| W/R*: | 1-A1<br>5-D7 |
| WATCHDOG*: | 8-D8<br>10-B1 |

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| REFDES | PAGE COORDINATES | REFDES | PAGE COORDINATES | REFDES | PAGE COORDINATES | REFDES | PAGE COORDINATES |
|---|---|---|---|---|---|---|---|
| U1: | 1-D7 | U66: | 9-D3<br>11-A6,A7,B5,B6,D5 | | | | |
| U2: | 1-B7 | U67: | 11-D4 | | | | |
| U3: | 1-D5 | U68: | 12-B7,D4 | | | | |
| U4: | 1-D3 | U69: | 13-C5 | | | | |
| U5: | 1-B3,C2<br>6-C2,D2 | U72: | 14-D7 | | | | |
| U6: | 1-B2 | U73: | 9-C2<br>11-C7,D7 | | | | |
| U13: | 2-C5 | | | | | | |
| U14: | 3-B7<br>6-A5 | | | | | | |
| U15: | 3-D7 | | | | | | |
| U16: | 3-D4 | | | | | | |
| U17: | 3-C4 | | | | | | |
| U29: | 4-D5 | | | | | | |
| U30: | 4-C5 | | | | | | |
| U31: | 4-D3 | | | | | | |
| U32: | 4-C3 | | | | | | |
| U33: | 4-B7 | | | | | | |
| U36: | 5-D5 | | | | | | |
| U40: | 6-D4 | | | | | | |
| U43: | 6-B4 | | | | | | |
| U44: | 7-D8 | | | | | | |
| U45: | 7-D7 | | | | | | |
| U47: | 7-B5 | | | | | | |
| U48: | 8-D7 | | | | | | |
| U49: | 8-B5 | | | | | | |
| U50: | 8-C5 | | | | | | |
| U51: | 8-D3 | | | | | | |
| U52: | 8-C3 | | | | | | |
| U54: | 9-B6 | | | | | | |
| U55: | 9-D4 | | | | | | |
| U56: | 9-C2,D2 | | | | | | |
| U57: | 10-D7 | | | | | | |
| U58: | 10-C7 | | | | | | |
| U59: | 10-D5 | | | | | | |
| U60: | 10-D4 | | | | | | |
| U61: | 10-D3 | | | | | | |
| U62: | 10-D2 | | | | | | |
| U63: | 10-B5 | | | | | | |
| U64: | 11-D6 | | | | | | |
| U65: | 11-C6 | | | | | | |

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| CONNECTOR | SIGNAL |
|---|---|
| J1-1: | PPT18 |
| J1-2: | PPT19 |
| J1-4: | GND |
| J1-6: | GND |
| J1-8: | GND |
| J1-12: | GND |
| J1-17: | PWRRTN |
| J1-18: | PWRBUS |
| J1-19: | PWRRTN |
| J1-20: | PWRBUS |
| J1-22: | GND |
| J1-24: | GND |
| J1-26: | GND |
| J1-27: | 06081019 |
| J1-28: | 06011025 |
| J1-29: | 06081020 |
| J1-30: | 06011022 |
| J1-31: | GND |
| J1-32: | 06011012 |
| J1-33: | GND |
| J1-34: | 06011010 |
| J1-35: | 06081023 |
| J1-36: | 06011007 |
| J1-37: | GND |
| J1-38: | 06011015 |
| J1-39: | GND |
| J1-40: | 06011017 |
| J1-41: | 06081026 |
| J1-42: | 06011020 |
| J1-43: | 06081027 |
| J1-44: | MINX_IRQ* |
| J1-45: | 06011053 |
| J1-46: | 06062061 |
| J1-47: | 06011051 |
| J1-48: | 06011048 |
| J1-49: | 06011046 |
| J1-50: | 06062065 |
| J1-51: | 06011041 |
| J1-53: | 06011036 |
| J1-54: | 06081044 |
| J1-55: | 06011038 |
| J1-57: | 06011043 |
| J1-58: | +5.0 |
| J1-59: | 5VAGND |
| J1-60: | -5.0 |
| J1-61: | +5 |
| J1-62: | +5 |
| J1-63: | GND |
| J1-64: | GND |

| CONNECTOR | SIGNAL |
|---|---|
| J2-1: | PWRBUS |
| J2-2: | PWRBUS |
| J2-3: | +16.5 |
| J2-4: | +16.5 |
| J2-5: | PWRRTN |
| J2-6: | PWRRTN |
| J2-7: | 14050016 |
| J2-8: | 14050020 |
| J2-9: | 14050007 |
| J2-10: | 14050011 |
| J2-11: | 14020033 |
| J2-12: | GND |
| J2-13: | 14020035 |
| J2-14: | GND |
| J2-17: | 14020045 |
| J2-18: | GND |
| J2-19: | 14020048 |
| J2-20: | GND |
| J2-21: | 14016058 |
| J2-24: | GND |
| J2-25: | BATT_ID* |
| J2-26: | SDI |
| J2-27: | SDO |
| J2-28: | CLK |
| J2-29: | SER_CMD* |
| J2-30: | STROBE* |
| J2-31: | GND |
| J2-32: | +5 |
| J2-33: | BATT_NC1 |
| J2-34: | BATT_NC2 |
| J2-35: | SHUTDOWN |
| J2-36: | CLR |
| J3-1: | PWRBUS |
| J3-2: | PWRBUS |
| J3-3: | PWRRTN |
| J3-4: | PWRRTN |
| J3-7: | GND |
| J3-8: | 14091033 |
| J3-9: | GND |
| J3-10: | 14091036 |
| J3-11: | +5 |
| J3-12: | 14091039 |
| J3-13: | +5 |
| J3-14: | 14086011 |

| CONNECTOR | SIGNAL |
|---|---|
| J4-1: | PWRBUS |
| J4-2: | PWRRTN |
| J4-3: | PWRBUS |
| J4-4: | PWRRTN |
| J4-5: | 13078035 |
| J4-7: | 13082036 |
| J4-8: | +5 |
| J4-9: | 13078037 |
| J4-10: | GND |
| J4-11: | 13082038 |
| J4-12: | 13031005 |
| J4-13: | 13078039 |
| J4-14: | 13044008 |
| J4-15: | 13082040 |
| J4-16: | 13080048 |
| J4-17: | 13078041 |
| J4-18: | 13080055 |
| J4-19: | 13082042 |
| J4-20: | 13080052 |
| J4-21: | 13080062 |
| J4-22: | 13080059 |
| J5-1: | 12090018 |
| J5-2: | 12093008 |
| J5-3: | 12094020 |
| J5-4: | 12090005 |
| J5-5: | 12090022 |
| J5-6: | 12094024 |
| J5-7: | 12093013 |
| J5-8: | 12090010 |
| J5-9: | 12090015 |
| J5-10: | PPT41 |
| J5-12: | GND |
| J5-13: | -12.8 |
| J5-14: | GND |
| J5-15: | +12.8 |
| J5-16: | +5.0 |
| J5-17: | 5VAGND |
| J5-18: | -5.0 |
| J5-19: | 5VAGND |
| J5-20: | 12012032 |
| J5-21: | 12012020 |
| J5-22: | 12012022 |
| J5-23: | 12012017 |
| J5-24: | GND |
| J5-25: | 12012034 |
| J5-26: | GND |
| J5-27: | 12012025 |
| J5-28: | 12012037 |
| J5-29: | +5 |
| J5-30: | 12012054 |
| J5-31: | +5 |
| J5-32: | PPT42 |
| J5-33: | +15.5 |
| J5-34: | PWRRTN |
| J5-35: | PWRRTN |
| J5-36: | +16.5 |
| J5-37: | +16.5 |
| J5-38: | PPT43 |
| J5-39: | PWRBUS |
| J5-40: | PWRBUS |

| CONNECTOR | SIGNAL |
|---|---|

# Assembly Revisions PN 800210

The baseline revision for this assembly is pn 800210-005B. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

## PN 800210-001E

This version of the assembly was used first in all of the A-series Tram modules. The corresponding parts location diagram, pn 800210-001E/002B, and schematic diagram, SD800210-001C, are found later in this chapter.

## PN 800210-002B

This version of the assembly replaced all processor PCBs in the A and SL-series Tram modules. The corresponding parts location diagram, pn 800210-001E/002B, and schematic diagram, SD800210-001C, are found later in this chapter.

## PN 800210-005A

This version of the assembly replaced all -001/002 processor PCBs in all Tram modules.

| Item | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|
| C1 | Cap, NPO, 47pF, 5%, 50V, SM | 411576-008 | 411576-019 | 1 |
| – | Schematic Diagram | 800210-005A | 800210-005B | |

# Parts List PN 800210-001E/002B

| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| BTI | Battery, 3V, Lithium, Coin-Type | 401981-001 | 1 |
| C1 | Cap, Cer, 47pF, 5%, 50V, SM | 1181-470 | 1 |
| C2 | Cap, Var, 4 - 25pF, SM | 401977-001 | 1 |
| C3, 6, 7, 10, 11, 17, 19,23, 25, 27, 29, 31-37,42, 43, 46-49, 61-65,72, 73, 74, 78, 79, 80,83-94, 96, 98, 99 | Cap, Cer, 0.1µF, 20%, 50V | 404370-001 | 50 |
| C4, 97 | Cap, Cer, 0.01µF, 5%, 50V, SM | 1182-103 | 2 |
| C5, 24, 26 | Cap, Tant, 4.7µF, 20%, 20V, SM | 402004-001 | 3 |
| C12, 20, 21, 28, 30 | Cap, Tant, 10µF, 20%, 10V, SM | 1176-106 | 5 |
| C13, 14, 15, 18, 38, 39,76 | Cap, Cer, 0.47µF, 20% | 1187-474 | 7 |
| C16, 40, 41, 44, 45, 68-71, 75, 77, 81, 82, 95 | Cap, Cer, 0.22µF, 20%, 50V, SM | 1187-224 | 14 |
| C22 | Cap, Tant, 10µF, 20%, 25V, SM | 1152-106 | 1 |
| C100, 101, 102 | Cap, Cer, 0.001µF, 5%, 50V, SM | 1181-102 | 3 |
| CR1, 6 | Diode, Schottky, SM BAT54 | 401985-001 | 2 |
| CR2, 10-13 | Diode Pair, Series, SM D7000 | 2013-201 | 5 |
| CR3 | Diode, Transient Voltage Suppression, SM P6SMB20AT1 | 403939-001 | 1 |
| CR5 | Diode, SM MMAD4148 | 401980-001 | 1 |
| CR8, 9 | Diode, Schottky, Barrier, 1A, 40V, SM MBRS140T3 | 403187-001 | 2 |
| CR14, 15 | Diode, Transient Voltage Suppressor, Bidirectional, 6.8V, 600W | 404121-001 | 2 |
| DS1 | Diode, Light-Emitting (Red/Green) LDGR 2340 | 402428-001 | 1 |
| J1 | Connector, PC Header, 64-Pin | 1847-064 | 1 |
| J2 | Connector, PC Header, 24-Pin, Vertical | 1778-224 | 1 |
| J3 | Connector, PC Header, 14-Pin | 408623-001 | 1 |
| J4 | Connector, PC Header, 22-Pin | 408623-002 | 1 |
| J5 | Connector, PC Header, 40-Pin | 1778-240 | 1 |
| Q1, 2, 3, 6, 7-10, 14, 16, 18, 19 | Transistor, NPN, SM T3904 | 2511-001 | 12 |
| Q4, 5 | Transistor, NPN, SM BCX56-1 | 2712-056 | 2 |
| Q11 | Transistor, PNP, SM T4403 | 401978-001 | 1 |
| Q13, 15, 17 | Transistor, PNP, SM T3906 | 2511-101 | 3 |
| R1, 2, 30, 31, 32, 57, 69, 70 | Res, Cer, 1K, 1%, 1/8W, SM | 1082-103 | 8 |
| R3, 7, 35, 47, 48, 72, 101-104 | Res, Cer, 49.9Ω, 1%, 1/8W, SM | 1082-799 | 10 |
| R4, 28 | Res, Cer, 100Ω, 1%, 1/8W, SM | 1082-755 | 2 |
| R5, 9, 25, 29, 34, 36, 82-85 | Res, Cer, 100K, 1%, 1/8W, SM | 1082-100 | 10 |

| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| R6, 10, 11, 12, 22, 23, 24, 26, 27, 37-41, 44, 52, 53, 59, 68, 88, 98 | Res, Cer, 10K, 1%, 1/8W, SM | 1082-104 | 22 |
| R8, 46, 90, 92 | Res, Cer, 1.5K, 1%, 1/8W, SM | 1082-768 | 4 |
| R13 | Res, Cer, 200K, 0.1%, 1/8W, SM | 1067-832 | 1 |
| R14 | Res, Cer, 22.9K, 0.1%, 1/8W, SM | 1067-833 | 1 |
| R19, 20 | Res, 0Ω, SM | 1082-756 | 2 |
| R21, 60, 61, 62, 93-97 | Res, Cer, 150Ω, 1%, 1/8W, SM | 1082-767 | 9 |
| R42, 43 | Res, Cer, 47.5K, 1%, 1/8W, SM | 1082-757 | 2 |
| R45, 49, 54 | Res, Cer, 3.4K, 1%, 1/8W, SM | 1082-759 | 3 |
| R50, 55, 56 | Res, Cer, 34.8K, 10%, 1/4W, SM | 1082-791 | 3 |
| R51 | Res, Cer, 249Ω, 1%, 1/8W, SM | 1082-793 | 1 |
| R63 | Res, Cer, 2.4M, 5%, 1/8W, SM | 1081-484 | 1 |
| R64 | Res, Var, 500K, Top Adjust | 401979-001 | 1 |
| R65 | Res, Cer, 3.9M, 5%, 1/8W, SM | 1081-485 | 1 |
| R66 | Res, Cer, 200Ω, 1%, 1/8W, SM | 1082-762 | 1 |
| R67 | Res, Cer, 22M, 5%, 1/8W, SM | 1081-486 | 1 |
| R71, 99 | Res, Cer, 340Ω, 1%, 1/8W, SM | 1082-790 | 2 |
| R73-77, 89, 91, 100 | Res, Cer, 4.75K, 1%, 1/8W, SM | 1082-760 | 8 |
| R78-81 | Res, Cer, 750Ω, 1%, 1/8W, SM | 1082-764 | 4 |
| S1 | Switch, Dual In-Line, 6-Station, SM | 401960-001 | 1 |
| U1, 47 | Buffer/Driver, Octal, SM HC541 | 401974-001 | 2 |
| U2 | EPLD, 68000 Interrupt Encoder, PLCC | 404570-001 | 1 |
| U3 | Microprocessor, 16-MHz, PLCC 68HC000 | 401968-001 | 1 |
| U4 | EPLD, 68000 Bus Control, PLCC | 408137-001 | 1 |
| U5 | Inverter, Hex, SM AC04 | 3062-004 | 1 |
| U6, 14, 33, 56, 73 | OR Gate, 2-Input, Quad, SM AC32 | 3062-032 | 5 |
| U7, 10, 11, 12 | Res Ntwk, 100K, SM | 1061-104 | 4 |
| U8, 9, 40 | Transceiver, Bus, Octal, SM ACQ245 | 408019-001 | 3 |
| U13 | Clock/Timer, SM DP8570 | 401970-001 | 1 |
| U15 | Volt Rgltr, Adj, SM LP2951A | 3076-001 | 1 |
| U16, 17 | EEPROM, Flash, 2K x 8-Bit, 150nS, PLCC 28F020 (For -001 Only) | 405858-002 | 2 |
| U16, 17 | EEPROM, Flash, 2K x 8-Bit, 150nS, PLCC 28F020 (For -002 Only) | 408792-002 | 2 |
| U29-32 | RAM, Static, 128K x 8-Bit, 100nS 628128L | 406255-001 | 4 |
| U36 | RAM, Dual Port, 4k x 8-Bit, 70nS, PLCC IDT7134 | 404007-002 | 1 |
| U37 | RAM, Dual-Port, 4k x 8-Bit, w/Arbitration Logic, 70nS, PLCC IDT71342 | 408123-001 | 1 |
| U38, 41, 71 | Res Ntwk, 100Ω | 1062-101 | 3 |
| U39 | Res Ntwk, 10K | 1061-103 | 1 |
| U43 | Buffer/Driver, Octal, SM AC541M | 401973-001 | 1 |
| U44 | Oscillator, CMOS, 14.7456MHz, SM | 401480-001 | 1 |
| U45 | Flip-Flop, Type D, Dual, SM HC74 | 3038-074 | 1 |

| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| U46 | Data Selector, 1-Line-of-4-Line, Three-State Output, Dual/Multiplexer, 4-Line-to-1-Line, Three-State Output, Dual, SM AC253 | 404012-001 | 1 |
| U48 | PAL, Programmed, Communication Control, PLCC 80C152JB | 400368-001 | 1 |
| U49 | Latch, Transparent, Three-State Output, Octal, SM HC573 | 401971-001 | 1 |
| U50 | AND Gate, 2-Input, Quad, SM AC08 | 402717-001 | 1 |
| U51 | RAM, Static, 32K x 8-Bit, SM 62256FLP | 3202-256 | 1 |
| U52 | EPROM, Programmed, 80C152 Boot Code, PLCC | 404904-002 | 1 |
| U53, 70 | Res Ntwk, 10K | 1062-103 | 2 |
| U54 | EPLD, 80C152 Communication Interface, PLCC | 408139-001 | 1 |
| U55 | Decoder/Demultiplexer, 4-Line-to-16-Line, SM HC154 | 404210-001 | 1 |
| U57, 58 | Shift Register, 8-Bit, Serial Input, Serial/Parallel Output, Tri-State Output, SM HC595 | 401969-001 | 2 |
| U59-62 | Shift Register, Parallel Load, 8-Bit, SM HC165 | 401972-001 | 4 |
| U63 | Microprocessor Support Circuit, SM MAX695 | 401966-001 | 1 |
| U64, 65 | Register, 8-Bit, SM HC273 | 3038-273 | 2 |
| U66 | Inverter, Hex, SM HC04 | 3038-004 | 1 |
| U67 | Hybrid, Analog Output | 401205-001 | 1 |
| U68 | Buffer, Tri-State Output, Hex, SM HC367 | 401967-001 | 1 |
| U69 | Transceiver, Bus, Octal, SM HC245 | 401963-001 | 1 |
| U72 | Line Driver/Receiver, Differential, SM DS8921AM | 404013-001 | 1 |
| W1, 2, 3 | Socket, Mini | 1818-201 | 7 |
| Y1 | Crystal, 32.768kHz, SM | 402085-001 | 1 |
| - | Connector, Header, Male/Male, 64-Pin (for J1) | 409203-001 | 1 |
| - | Jumper, Mini (for W1, W3) | 1859-201 | 2 |
| - | Lubricant, Anti-Fretting (for U67) | 410286-001 | AR |
| - | Mounting Pad, Battery (for BT1) | 404368-001 | 1 |
| - | Socket, Hybrid (for U67) | 404596-001 | 2 |
| - | Socket, PLCC, 28-Pin, SM (for U2) (For -001 Only) | 402413-001 | 1 |
| - | Socket, PLCC, 32-Pin, SM (for U52) (For -001 Only) | 403802-001 | 1 |
| - | Socket, PLCC, 44-Pin, SM (for U4, 54) (For -001 Only) | 402412-001 | 2 |
| - | Socket, PLCC, 68-Pin, SM (for U48) | 402411-001 | 1 |
| - | Circuit Board | 800211-001C | 1 |
| - | Schematic Diagram | SD800210-001C | – |

# Schematic Diagram PN SD800210-001C

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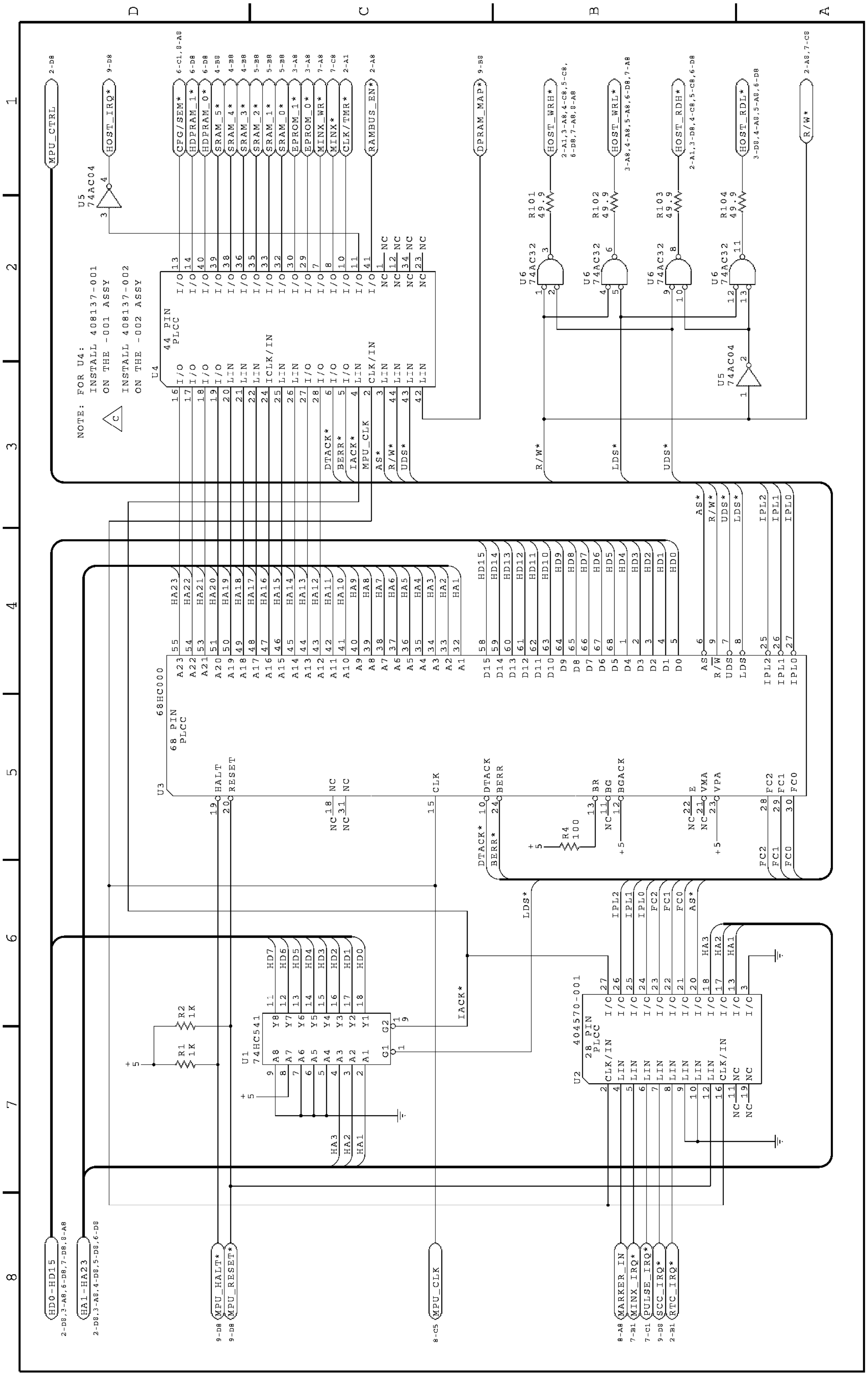

D
C
B
A
1
2
3
4
5
6
7
8
MPU_CTRL
HOST_IRQ*
CPG/SEM*
HDPRAM_1*
HDPRAM_0*
SRAM_5*
SRAM_4*
SRAM_3*
SRAM_2*
SRAM_1*
SRAM_0*
EPROM_1*
EPROM_0*
MINX_WR*
MINX*
CLK/TMR*
RAMBUS_EN*
DPRAM_MAP*
HOST_WRH*
HOST_WRL*
HOST_RDH*
HOST_RDL*
R/W*
U5
74AC04
R101 49.9
R102 49.9
R103 49.9
R104 49.9
U6
74AC32
NOTE: FOR U4:
INSTALL 408137-001
ON THE -001 ASSY
INSTALL 408137-002
ON THE -002 ASSY
C
U4
44 PIN
PLCC
DTACK*
BERR*
IACK*
MPU_CLK
AS*
R/W*
UDS*
LDS*
U3
68 PIN
PLCC
68HC000
HALT
RESET
CLK
DTACK
BERR
BR
BG
BGACK
E
VMA
VPA
FC2
FC1
FC0
IPL2
IPL1
IPL0
R4 100
+5
NC
U1
74HC541
R1 1K
R2 1K
U2
28 PIN
PLCC
404570-001
CLK/IN
HD0-HD15
HA1-HA23
MPU_HALT*
MPU_RESET*
MPU_CLK
MARKER_IN
MINX_IRQ*
PULSE_IRQ*
SCC_IRQ*
RTC_IRQ*

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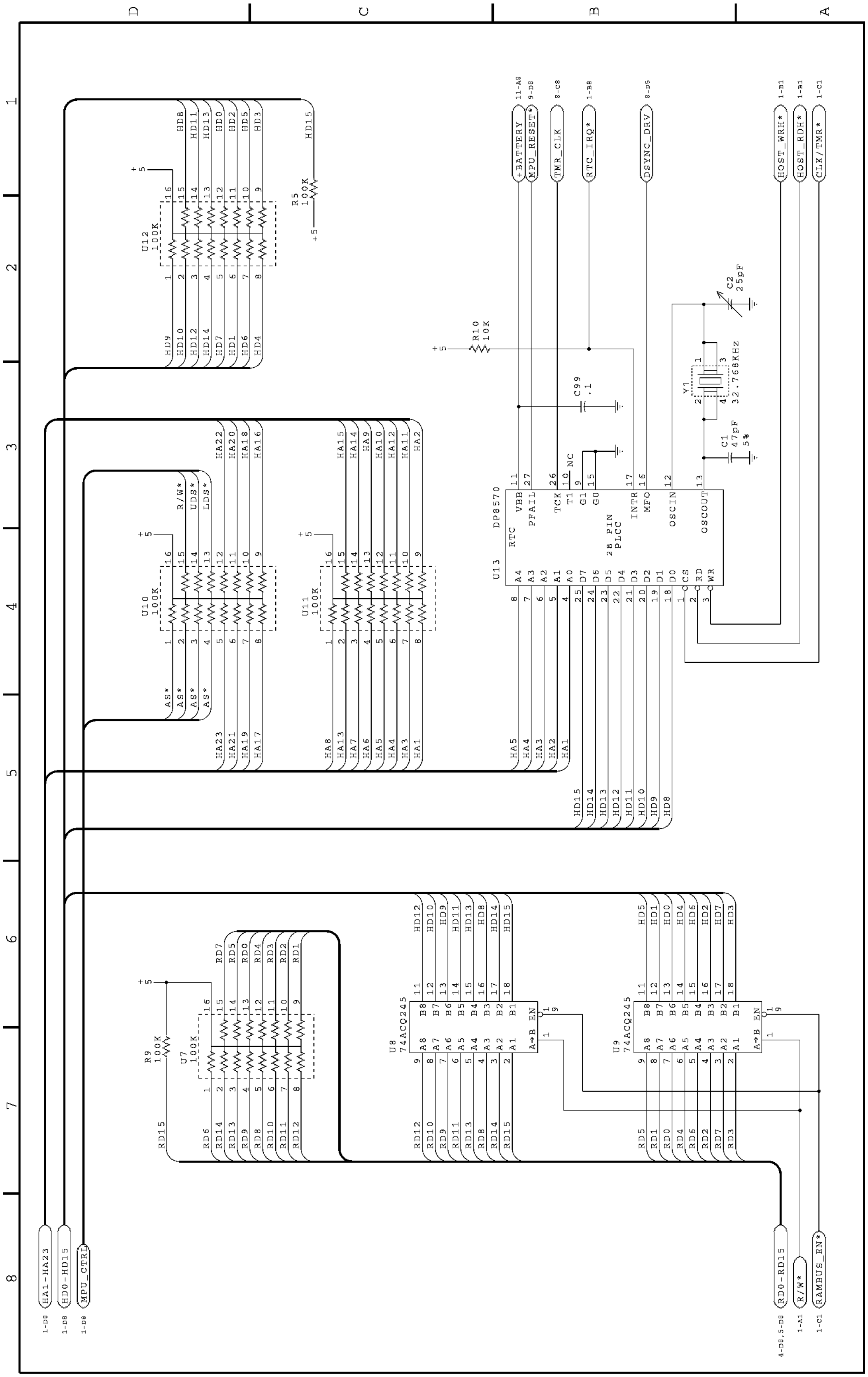
D
C
B
A
1
2
3
4
5
6
7
8
U12
100K
U10
100K
U11
100K
U7
100K
R5
100K
R9
100K
R10
10K
+5
U13
DP8570
RTC
28 PIN
PLCC
VBB
PFAIL
TCK
T1
G1
G0
INTR
MFO
OSCIN
OSCOUT
CS
RD
WR
NC
C99
.1
C2
25pF
C1
47pF
5%
Y1
32.768KHz
U8
74ACQ245
U9
74ACQ245
A→B
EN
+BATTERY
MPU_RESET*
TMR_CLK
RTC_IRQ*
DSYNC_DRV
HOST_WRH*
HOST_RDH*
CLK/TMR*
11-A8
9-D8
8-C8
1-B8
8-D5
1-B1
1-B1
1-C1
HA1-HA23
HD0-HD15
MPU_CTRL
1-D8
1-D8
1-D8
RD0-RD15
R/W*
RAMBUS_EN*
4-D8,5-D8
1-A1
1-C1
AS*
R/W*
UDS*
LDS*

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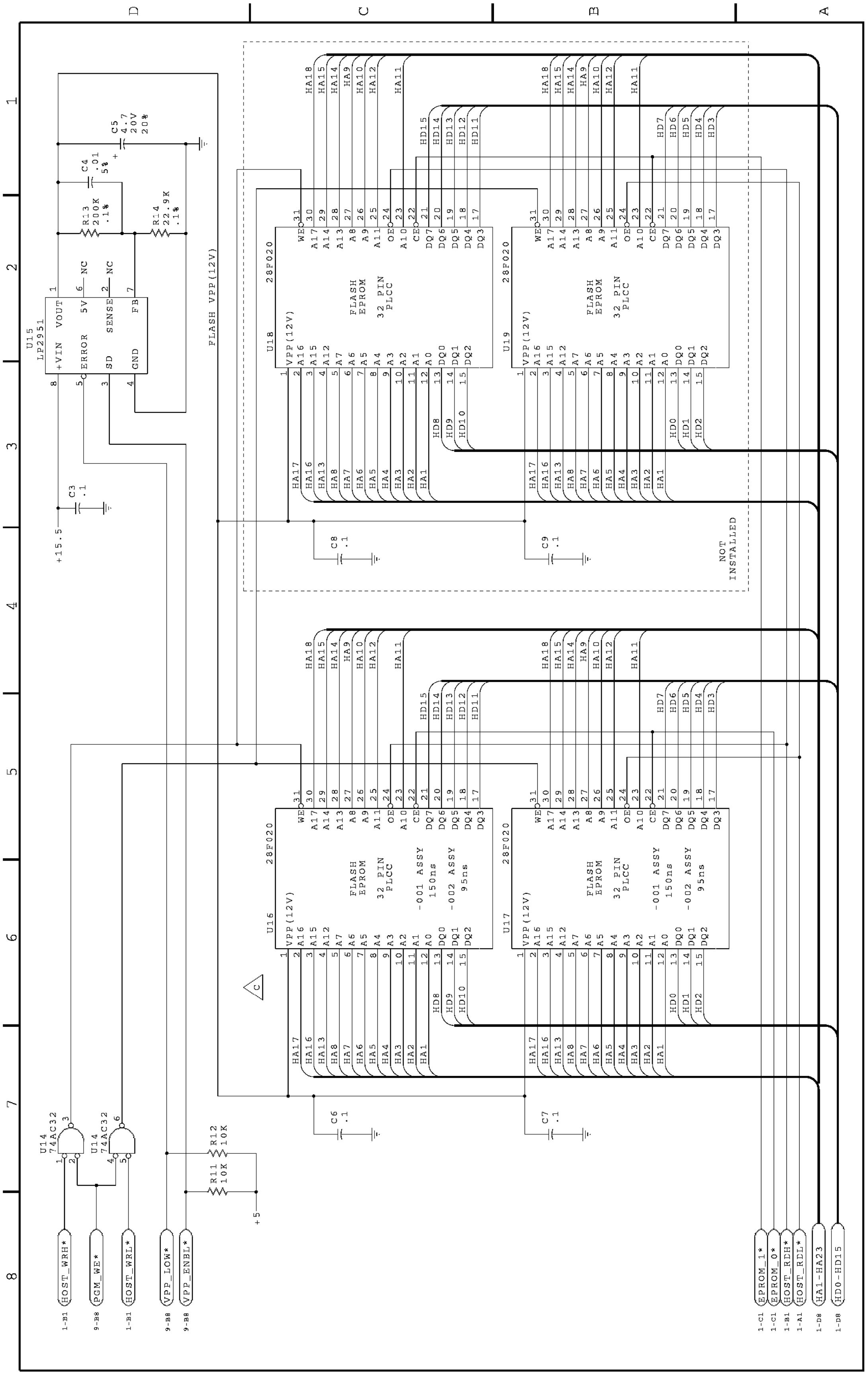
U15
LP2951
+VIN
VOUT
ERROR
5V
SD
SENSE
GND
FB
NC
C5
4.7
20V
20%
C4
.01
5%
R13
200K
.1%
R14
22.9K
.1%
C3
.1
+15.5
FLASH VPP(12V)
U18
U19
U16
U17
28F020
FLASH
EPROM
32 PIN
PLCC
-001 ASSY
150ns
-002 ASSY
95ns
VPP(12V)
WE
OE
CE
C8
.1
C9
.1
C6
.1
C7
.1
NOT
INSTALLED
U14
74AC32
R11
10K
R12
10K
+5
HOST_WRH*
PGM_WE*
HOST_WRL*
VPP_LOW*
VPP_ENBL*
EPROM_1*
EPROM_0*
HOST_RDH*
HOST_RDL*
HA1-HA23
HD0-HD15
1-B1
9-B8
1-C1
1-A1
1-D8

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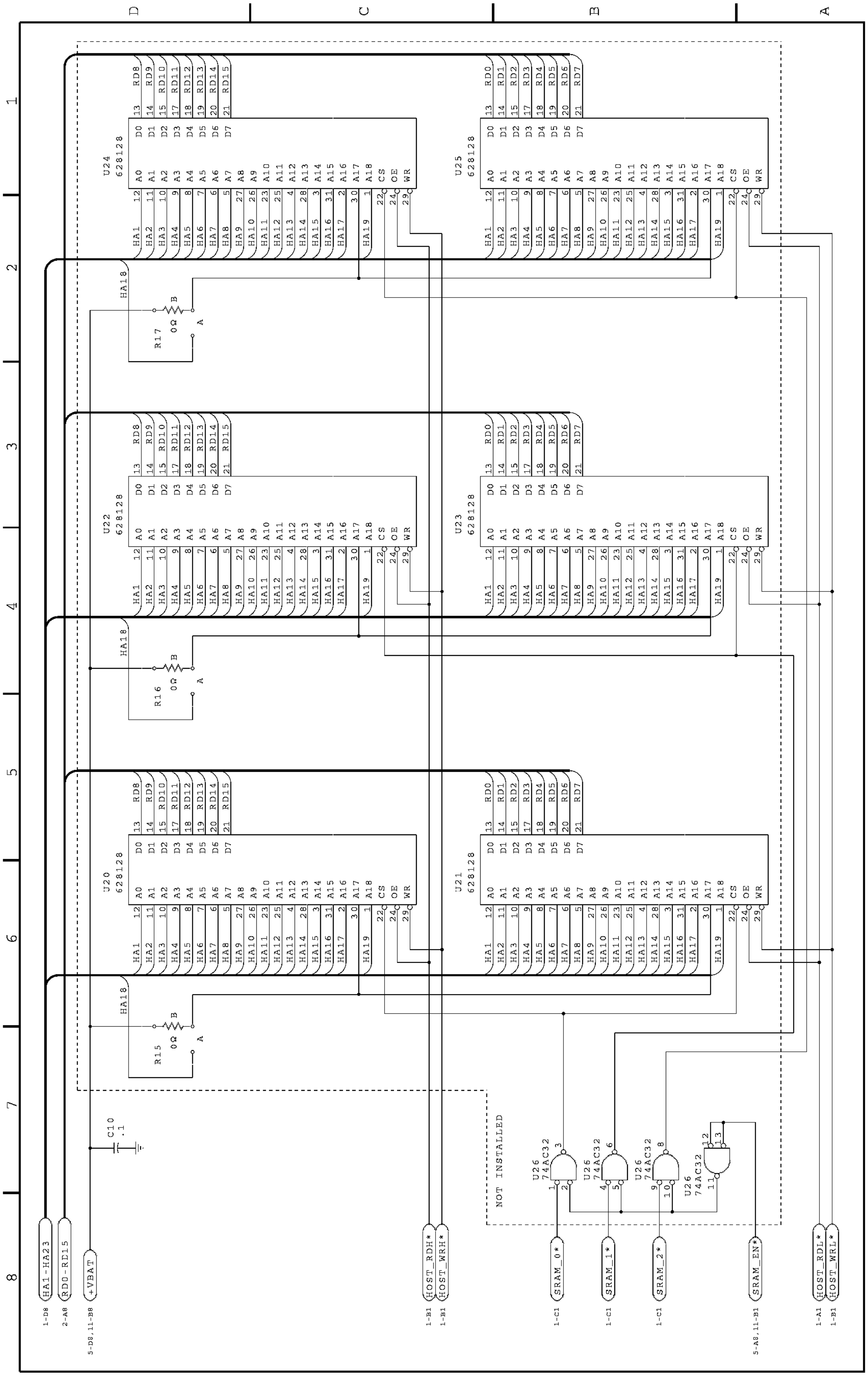
D
C
B
A
1
2
3
4
5
6
7
8
U24
628128
U25
628128
U22
628128
U23
628128
U20
628128
U21
628128
HA18
R17
0Ω
R16
0Ω
R15
0Ω
C10
.1
NOT INSTALLED
U26
74AC32
HA1-HA23
RD0-RD15
+VBAT
HOST_RDH*
HOST_WRH*
SRAM_0*
SRAM_1*
SRAM_2*
SRAM_EN*
HOST_RDL*
HOST_WRL*
1-D8
2-A8
5-D8,11-B8
1-B1
1-B1
1-C1
1-C1
1-C1
5-A8,11-B1
1-A1
1-B1

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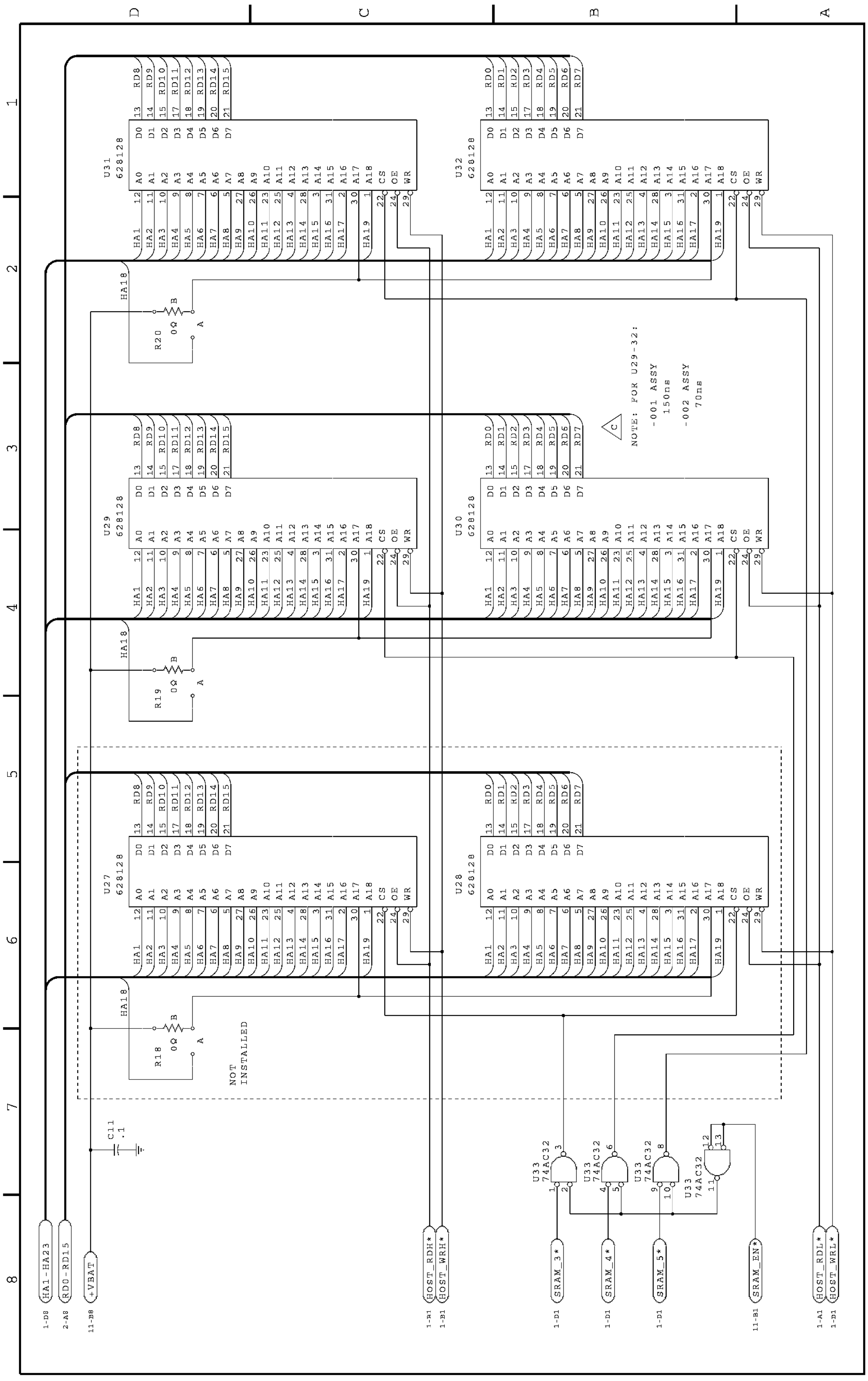
U31
628128
U32
628128
U29
628128
U30
628128
U27
628128
U28
628128
R20
0Ω
R19
0Ω
R18
0Ω
HA18
NOTE: FOR U29-32:
-001 ASSY
150ns
-002 ASSY
70ns
NOT INSTALLED
C11
.1
U33
74AC32
HA1-HA23
RD0-RD15
+VBAT
HOST_RDH*
HOST_WRH*
SRAM_3*
SRAM_4*
SRAM_5*
SRAM_EN*
HOST_RDL*
HOST_WRL*
1-D8
2-A8
11-B8
1-B1
1-B1
1-D1
1-D1
1-D1
11-B1
1-A1
1-D1
A
B
C
D
1
2
3
4
5
6
7
8

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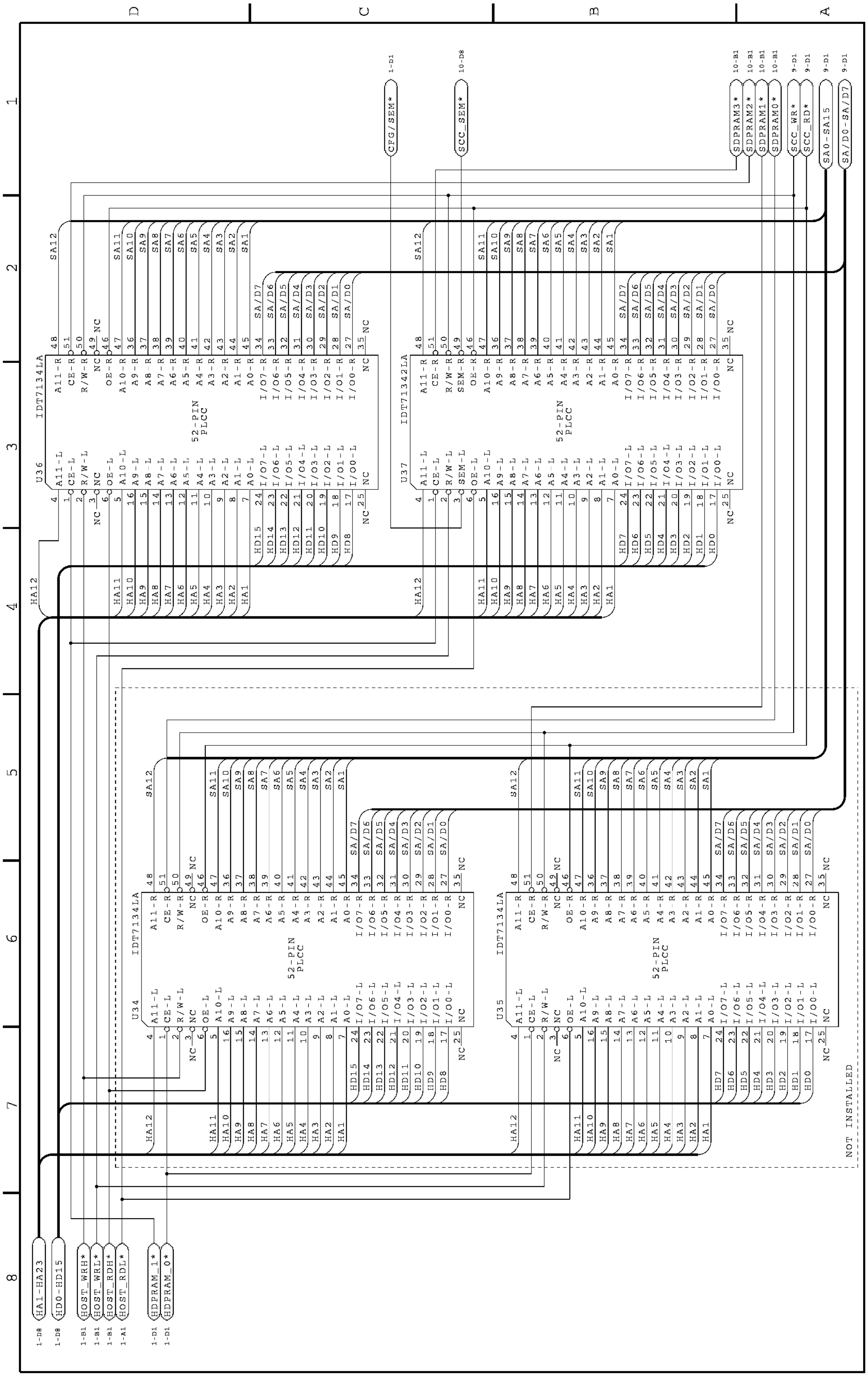
D
C
B
A
1
2
3
4
5
6
7
8
CFG/SEM* 1-D1
SCC_SEM* 10-D8
SDPRAM3* 10-B1
SDPRAM2* 10-B1
SDPRAM1* 10-B1
SDPRAM0* 10-B1
SCC_WR* 9-D1
SCC_RD* 9-D1
SA0-SA15 9-D1
SA/D0-SA/D7 9-D1
U36
IDT7134LA
52-PIN PLCC
U37
IDT71342LA
52-PIN PLCC
U34
IDT7134LA
52-PIN PLCC
U35
IDT7134LA
52-PIN PLCC
NOT INSTALLED
HA1-HA23 1-D8
HD0-HD15 1-D8
HOST_WRH* 1-B1
HOST_WRL* 1-B1
HOST_RDH* 1-B1
HOST_RDL* 1-A1
HDPRAM_1* 1-D1
HDPRAM_0* 1-D1

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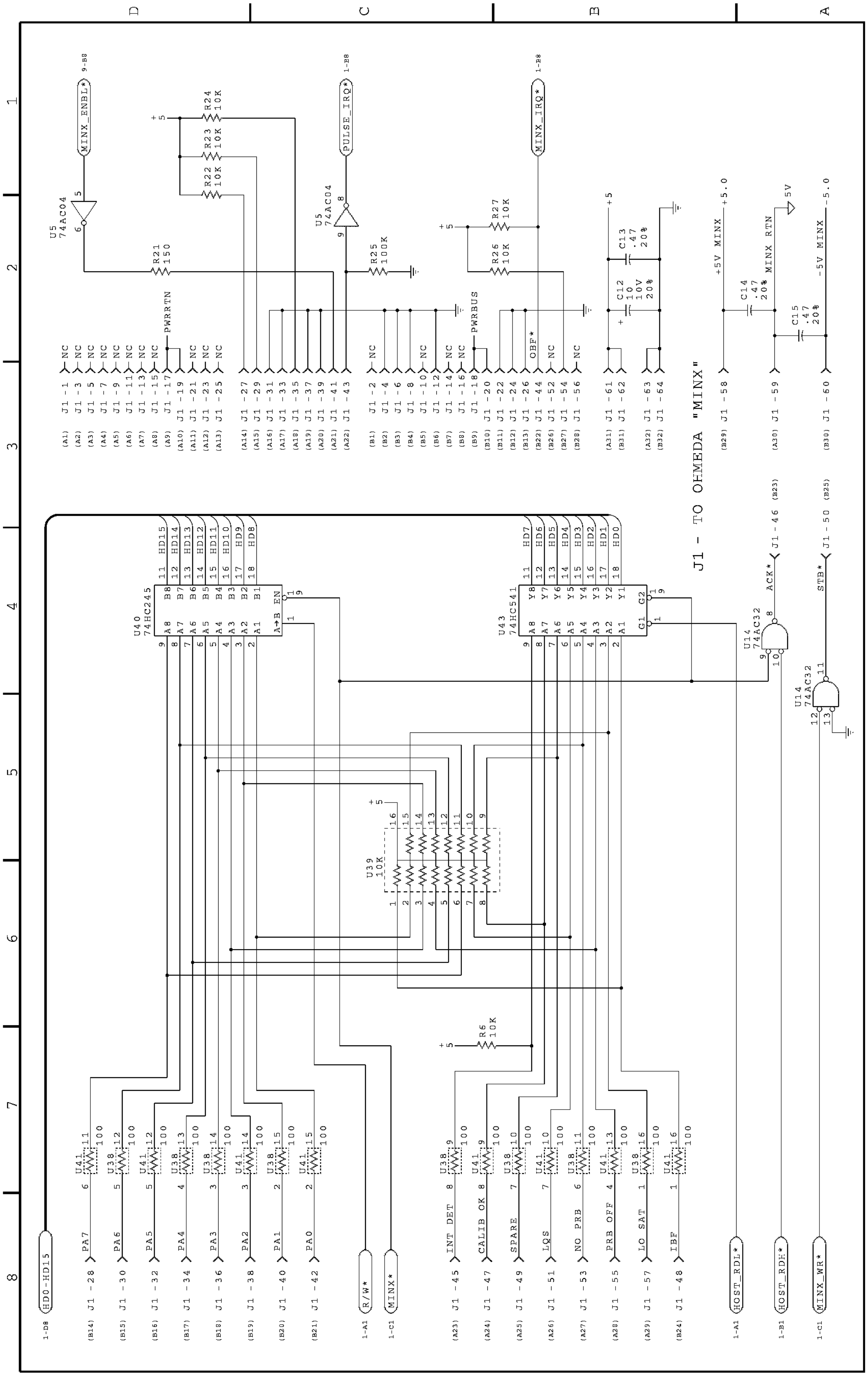
J1 - TO OHMEDA "MINX"
MINX_ENBL*
PULSE_IRQ*
MINX_IRQ*
U5 74AC04
R21 150
R22 10K
R23 10K
R24 10K
R25 100K
R26 10K
R27 10K
R6 10K
PWRRTN
PWRBUS
OBF*
C12 10 10V 20%
C13 .47 20%
C14 .47 20%
C15 .47 20%
+5V MINX +5.0
MINX RTN
-5V MINX -5.0
5V
U40 74HC245
U43 74HC541
U14 74AC32
U39 10K
ACK*
STB*
HD0-HD15
HD15
HD14
HD13
HD12
HD11
HD10
HD9
HD8
HD7
HD6
HD5
HD4
HD3
HD2
HD1
HD0
PA7
PA6
PA5
PA4
PA3
PA2
PA1
PA0
R/W*
MINX*
INT DET
CALIB OK
SPARE
LQS
NO PRB
PRB OFF
LO SAT
IBF
HOST_RDL*
HOST_RDH*
MINX_WR*
U41
U38
100
NC
A
B
C
D
1
2
3
4
5
6
7
8

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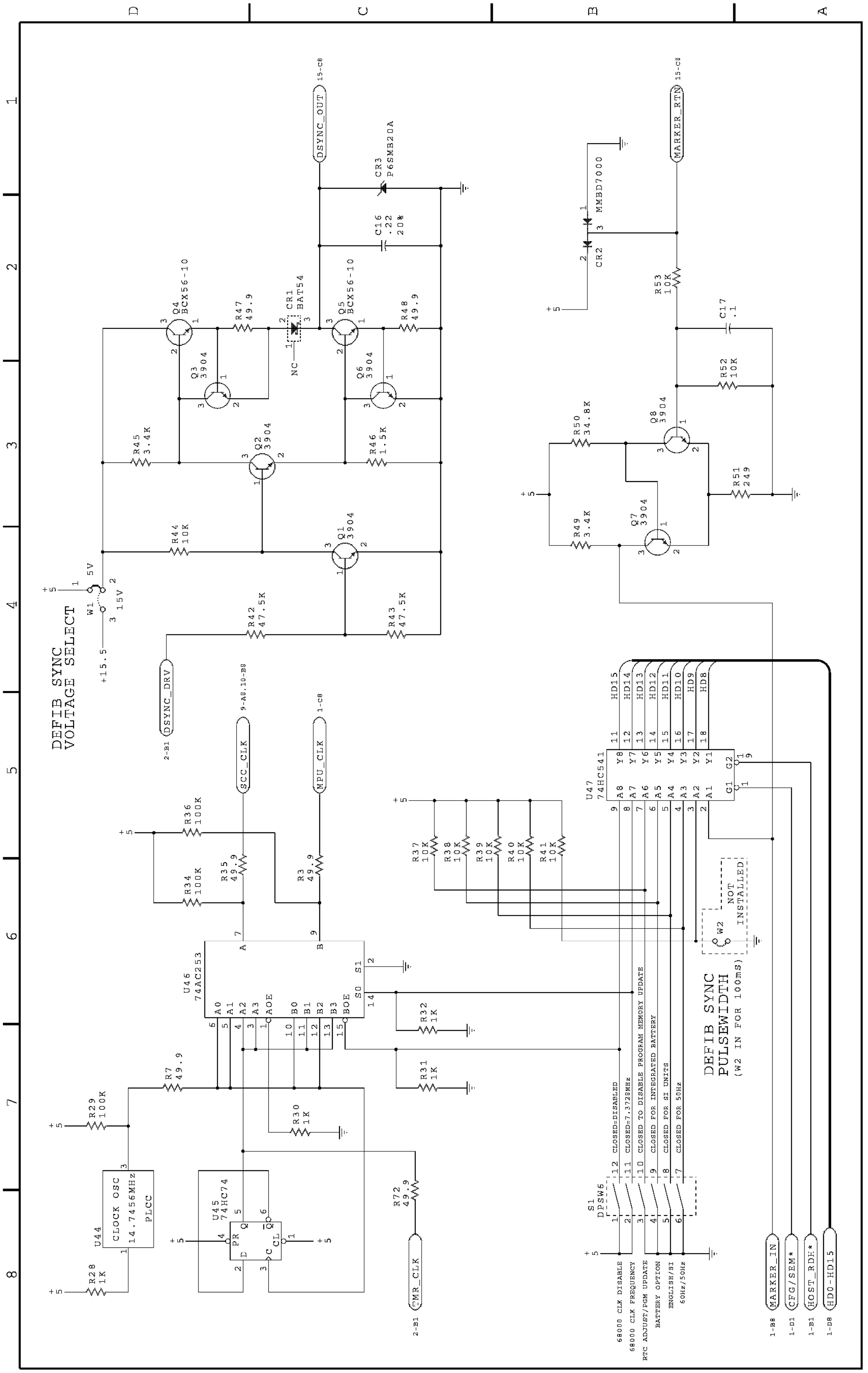
DEFIB SYNC
VOLTAGE SELECT
DEFIB SYNC
PULSEWIDTH
(W2 IN FOR 100mS)
DSYNC_OUT
DSYNC_DRV
MARKER_RTN
SCC_CLK
MPU_CLK
TMR_CLK
MARKER_IN
CFG/SEM*
HOST_RDH*
HD0-HD15
U44
CLOCK OSC
14.7456MHz
PLCC
U45
74HC74
U46
74AC253
U47
74HC541
Q1 3904
Q2 3904
Q3 3904
Q4 BCX56-10
Q5 BCX56-10
Q6 3904
Q7 3904
Q8 3904
CR1 BAT54
CR2 MMBD7000
CR3 P6SMB20A
C16 .22 20%
C17 .1
W1
W2
NOT INSTALLED
S1 DPSW6
12 CLOSED=DISABLED
11 CLOSED=7.3728MHz
10 CLOSED TO DISABLE PROGRAM MEMORY UPDATE
9 CLOSED FOR INTEGRATED BATTERY
8 CLOSED FOR SI UNITS
7 CLOSED FOR 50Hz
68000 CLK DISABLE
68000 CLK FREQUENCY
RTC ADJUST/PGM UPDATE
BATTERY OPTION
ENGLISH/SI
60Hz/50Hz
R28 1K
R29 100K
R7 49.9
R30 1K
R31 1K
R32 1K
R72 49.9
R34 100K
R35 49.9
R36 100K
R3 49.9
R37 10K
R38 10K
R39 10K
R40 10K
R41 10K
R42 47.5K
R43 47.5K
R44 10K
R45 3.4K
R46 1.5K
R47 49.9
R48 49.9
R49 3.4K
R50 34.8K
R51 249
R52 10K
R53 10K
+5
+15.5
5V
15V
NC
HD8
HD9
HD10
HD11
HD12
HD13
HD14
HD15
15-C8
2-B1
9-A8,10-B8
1-C8
1-B8
1-D1
1-B1
1-D8
D
C
B
A
1
2
3
4
5
6
7
8

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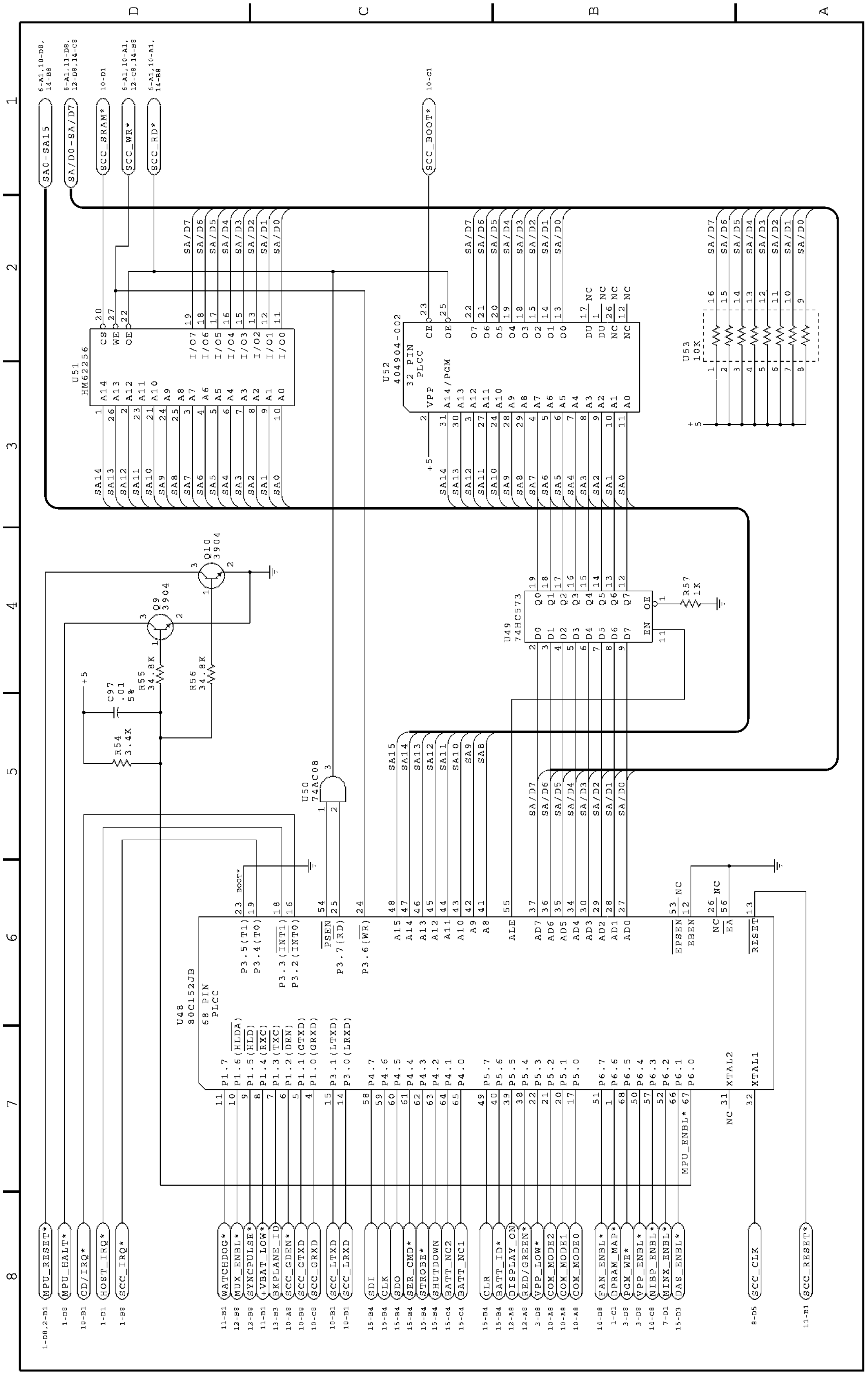
D
C
B
A
1
2
3
4
5
6
7
8
SAC-SA15
SA/D0-SA/D7
SCC_SRAM*
SCC_WR*
SCC_RD*
SCC_BOOT*
U51
HM62256
U52
404904-002
32 PIN
PLCC
U53
10K
U49
74HC573
R57
1K
Q10
3904
Q9
3904
R55
34.8K
R56
34.8K
C97
.01
5%
R54
3.4K
+5
U50
74AC08
U48
80C152JB
68 PIN
PLCC
BOOT*
NC
MPU_ENBL*
MPU_RESET*
MPU_HALT*
CD/IRQ*
HOST_IRQ*
SCC_IRQ*
WATCHDOG*
MUX_ENBL*
SYNCPULSE*
+VBAT_LOW*
BKPLANE_ID
SCC_GDEN*
SCC_GTXD
SCC_GRXD
SCC_LTXD
SCC_LRXD
SDI
CLK
SDO
SER_CMD*
STROBE*
SHUTDOWN
BATT_NC2
BATT_NC1
CLR
BATT_ID*
DISPLAY_ON
RED/GREEN*
VPP_LOW*
COM_MODE2
COM_MODE1
COM_MODE0
FAN_ENBL*
DPRAM_MAP*
PGM_WE*
VPP_ENBL*
NIBP_ENBL*
MINX_ENBL*
DAS_ENBL*
SCC_CLK
SCC_RESET*

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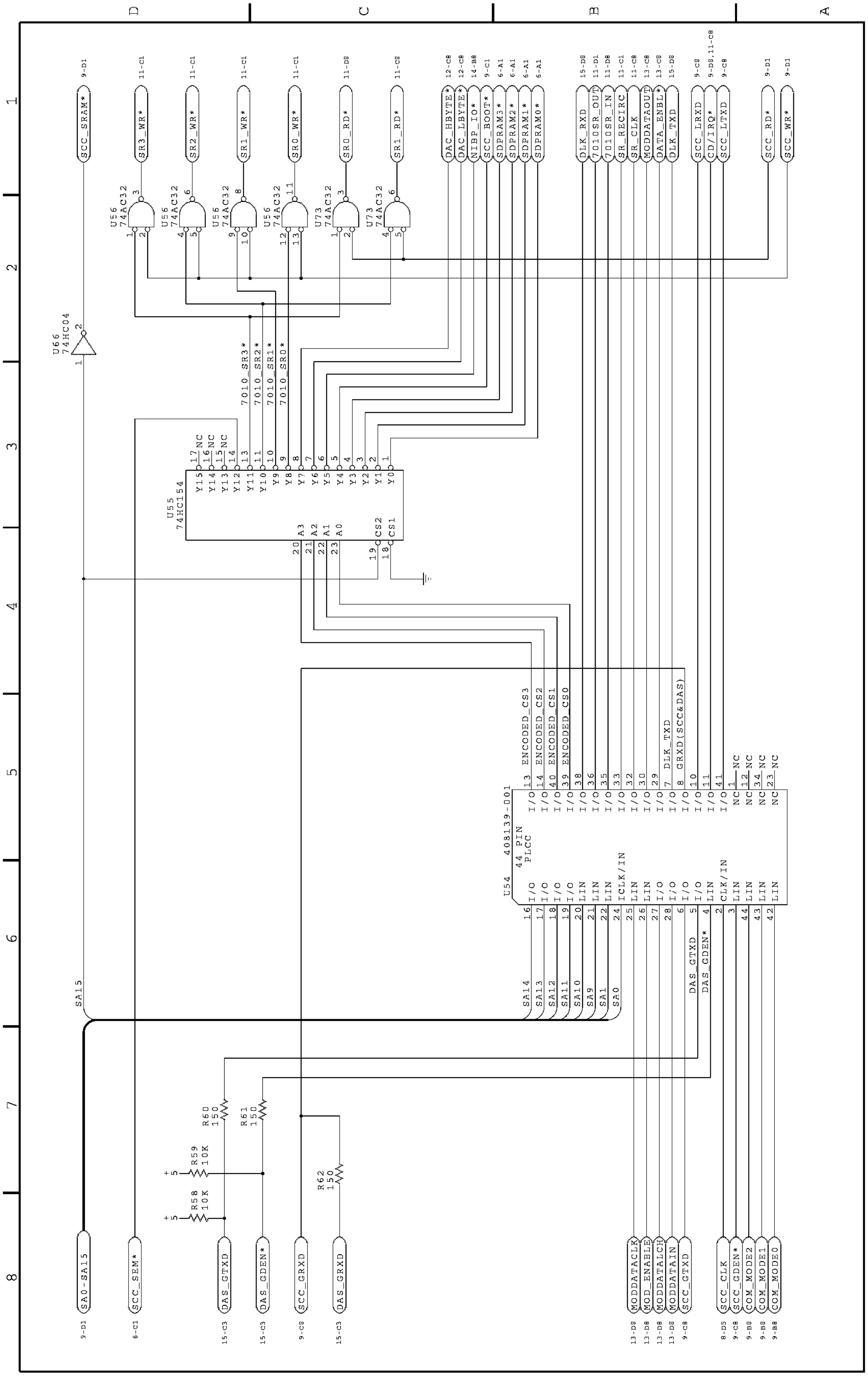
SCC_SRAM*
SR3_WR*
SR2_WR*
SR1_WR*
SR0_WR*
SR0_RD*
SR1_RD*
DAC_HBYTE*
DAC_LBYTE*
NIBP_IO*
SCC_BOOT*
SDPRAM3*
SDPRAM2*
SDPRAM1*
SDPRAM0*
DLK_RXD
7010SR_OUT
7010SR_IN
SR_RECIRC
SR_CLK
MODDATAOUT
DATA_ENBL*
DLK_TXD
SCC_LRXD
CD/IRQ*
SCC_LTXD
SCC_RD*
SCC_WR*
U56 74AC32
U73 74AC32
U66 74HC04
7010 SR3*
7010 SR2*
7010 SR1*
7010 SR0*
U55 74HC154
Y15 Y14 Y13 Y12 Y11 Y10 Y9 Y8 Y7 Y6 Y5 Y4 Y3 Y2 Y1 Y0
A3 A2 A1 A0 CS2 CS1
NC
U54 408139-001 44 PIN PLCC
ENCODED_CS3
ENCODED_CS2
ENCODED_CS1
ENCODED_CS0
DLK_TXD
GRXD(SCC&DAS)
I/O
LIN
ICLK/IN
CLK/IN
SA15
SA14 SA13 SA12 SA11 SA10 SA9 SA1 SA0
DAS_GTXD
DAS_GDEN*
R60 150
R61 150
R59 10K
R58 10K
R62 150
+5
SA0-SA15
SCC_SEM*
DAS_GTXD
DAS_GDEN*
SCC_GRXD
DAS_GRXD
MODDATACLK
MOD_ENABLE
MODDATALCH
MODDATAIN
SCC_GTXD
SCC_CLK
SCC_GDEN*
COM_MODE2
COM_MODE1
COM_MODE0
D C B A
1 2 3 4 5 6 7 8

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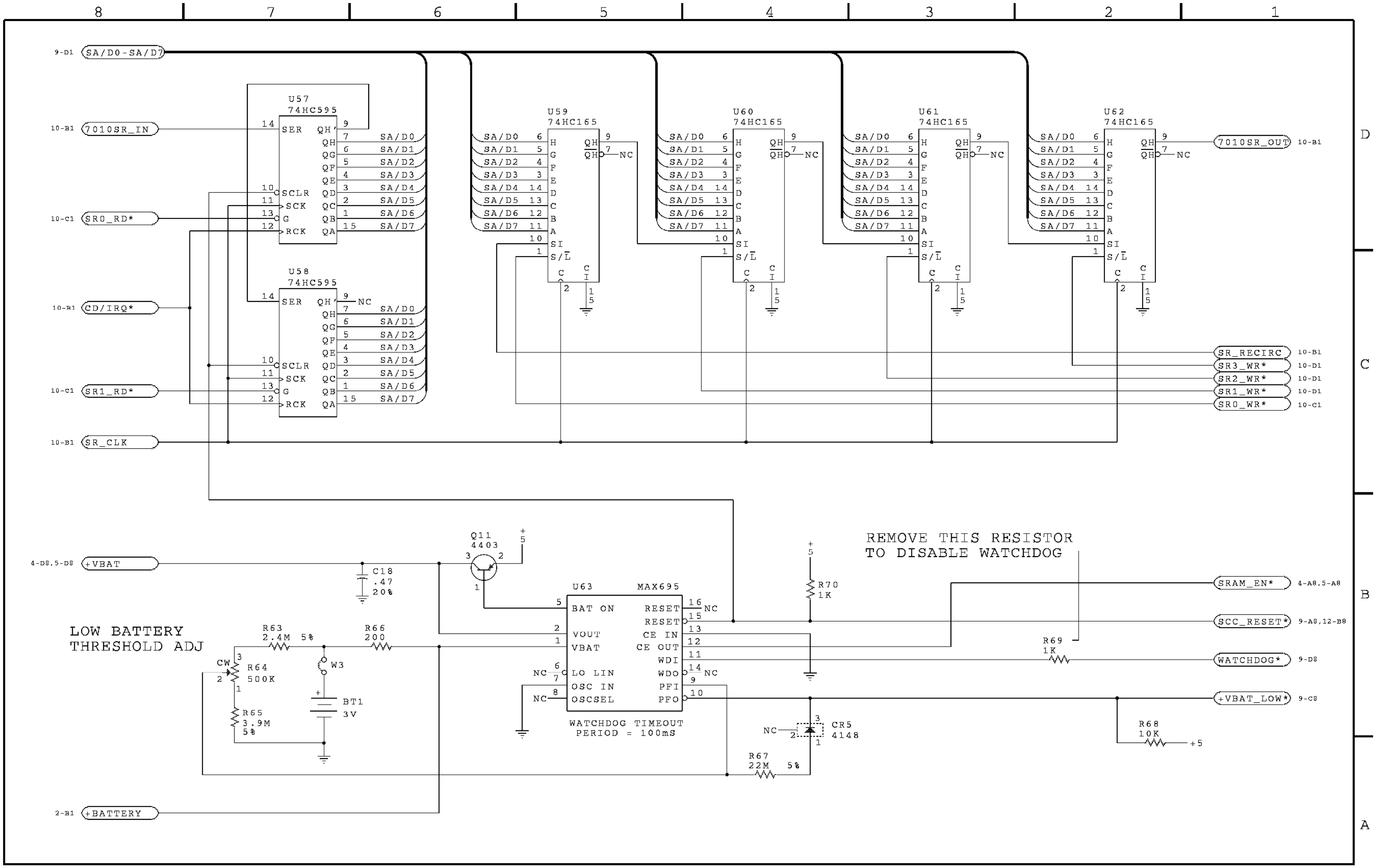
8
7
6
5
4
3
2
1
D
C
B
A
9-D1 SA/D0-SA/D7
10-B1 7010SR_IN
10-C1 SR0_RD*
10-B1 CD/IRQ*
10-C1 SR1_RD*
10-B1 SR_CLK
4-D8,5-D8 +VBAT
2-B1 +BATTERY
U57 74HC595
U58 74HC595
SER
QH'
QH
QG
QF
QE
QD
QC
QB
QA
SCLR
SCK
G
RCK
U59 74HC165
U60 74HC165
U61 74HC165
U62 74HC165
SA/D0
SA/D1
SA/D2
SA/D3
SA/D4
SA/D5
SA/D6
SA/D7
H
G
F
E
D
C
B
A
SI
S/L
CI
NC
7010SR_OUT 10-B1
SR_RECIRC 10-B1
SR3_WR* 10-D1
SR2_WR* 10-D1
SR1_WR* 10-D1
SR0_WR* 10-C1
Q11 4403
+5
C18 .47 20%
U63 MAX695
BAT ON
VOUT
VBAT
LO LIN
OSC IN
OSCSEL
RESET
CE IN
CE OUT
WDI
WDO
PFI
PFO
WATCHDOG TIMEOUT PERIOD = 100mS
LOW BATTERY THRESHOLD ADJ
R63 2.4M 5%
R64 500K
CW
R65 3.9M 5%
R66 200
W3
BT1 3V
R67 22M 5%
CR5 4148
R70 1K
REMOVE THIS RESISTOR TO DISABLE WATCHDOG
R69 1K
R68 10K
SRAM_EN* 4-A8,5-A8
SCC_RESET* 9-A8,12-B8
WATCHDOG* 9-D8
+VBAT_LOW* 9-C8

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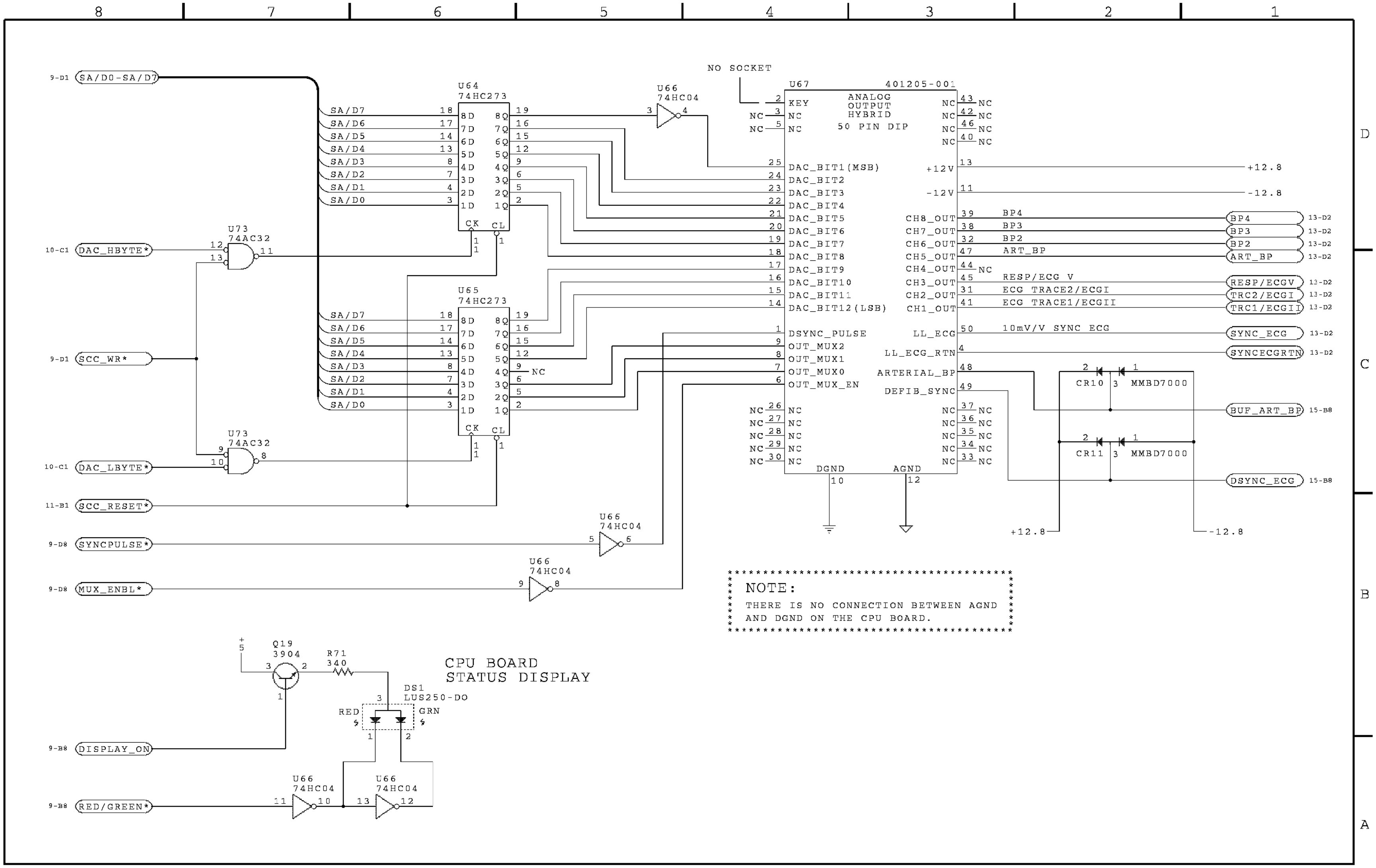
SA/D0-SA/D7
DAC_HBYTE*
SCC_WR*
DAC_LBYTE*
SCC_RESET*
SYNCPULSE*
MUX_ENBL*
DISPLAY_ON
RED/GREEN*
U64 74HC273
U65 74HC273
U66 74HC04
U73 74AC32
SA/D7
SA/D6
SA/D5
SA/D4
SA/D3
SA/D2
SA/D1
SA/D0
CK
CL
NC
NO SOCKET
U67 401205-001
ANALOG OUTPUT HYBRID
50 PIN DIP
KEY
DAC_BIT1(MSB)
DAC_BIT2
DAC_BIT3
DAC_BIT4
DAC_BIT5
DAC_BIT6
DAC_BIT7
DAC_BIT8
DAC_BIT9
DAC_BIT10
DAC_BIT11
DAC_BIT12(LSB)
DSYNC_PULSE
OUT_MUX2
OUT_MUX1
OUT_MUX0
OUT_MUX_EN
DGND
AGND
+12V
-12V
CH8_OUT
CH7_OUT
CH6_OUT
CH5_OUT
CH4_OUT
CH3_OUT
CH2_OUT
CH1_OUT
LL_ECG
LL_ECG_RTN
ARTERIAL_BP
DEFIB_SYNC
+12.8
-12.8
BP4
BP3
BP2
ART_BP
RESP/ECG V
ECG TRACE2/ECGI
ECG TRACE1/ECGII
10mV/V SYNC ECG
RESP/ECGV
TRC2/ECGI
TRC1/ECGII
SYNC_ECG
SYNCECGRTN
BUF_ART_BP
DSYNC_ECG
CR10 MMBD7000
CR11 MMBD7000
Q19 3904
R71 340
DS1 LUS250-DO
RED
GRN
+5
CPU BOARD STATUS DISPLAY
9-D1
10-C1
11-B1
9-D8
9-B8
13-D2
15-B8

NOTE:
THERE IS NO CONNECTION BETWEEN AGND AND DGND ON THE CPU BOARD.

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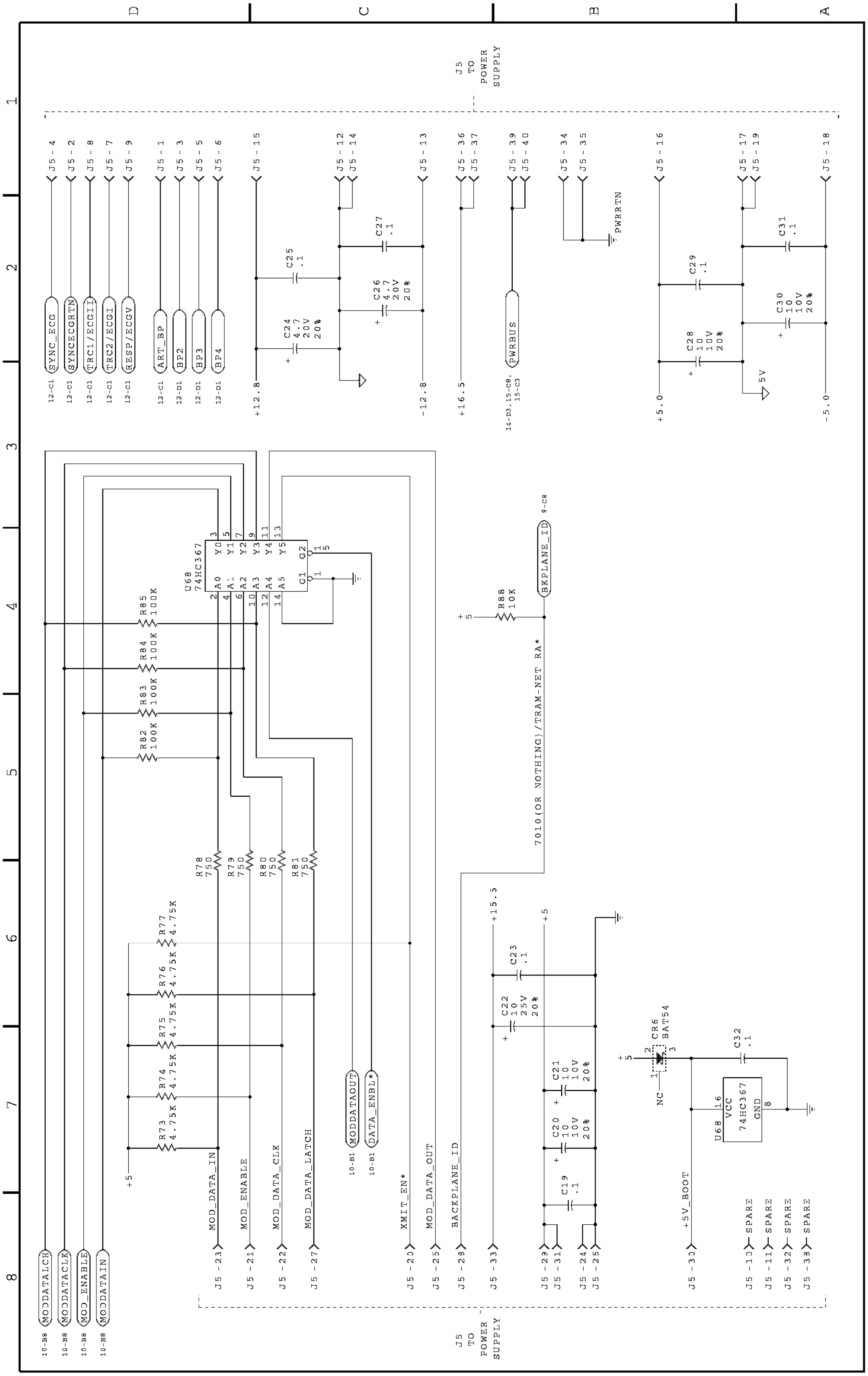
D
C
B
A
1
2
3
4
5
6
7
8
J5 TO POWER SUPPLY
J5-4
J5-2
J5-8
J5-7
J5-9
J5-1
J5-3
J5-5
J5-6
J5-15
J5-12
J5-14
J5-13
J5-36
J5-37
J5-39
J5-40
J5-34
J5-35
J5-16
J5-17
J5-19
J5-18
SYNC_ECG
SYNCECGRTN
TRC1/ECGI1
TRC2/ECGI
RESP/ECGV
ART_BP
BP2
BP3
BP4
12-C1
12-D1
PWRBUS
14-D3,15-C8, 15-C3
PWRRTN
C25 .1
C24 4.7 20V 20%
C27 .1
C26 4.7 20V 20%
C29 .1
C28 10 10V 20%
C31 .1
C30 10 10V 20%
5V
+12.8
-12.8
+16.5
+5.0
-5.0
U68 74HC367
A0 A1 A2 A3 A4 A5
Y0 Y1 Y2 Y3 Y4 Y5
G1 G2
BKPLANE_ID 9-C8
R88 10K
+5
7010(OR NOTHING)/TRAM-NET RA*
R85 100K
R84 100K
R83 100K
R82 100K
R78 750
R79 750
R80 750
R81 750
R77 4.75K
R76 4.75K
R75 4.75K
R74 4.75K
R73 4.75K
MODDATAOUT
DATA_ENBL*
10-B1
+15.5
C23 .1
C22 10 25V 20%
C21 10 10V 20%
C20 10 10V 20%
C19 .1
CR6 BAT54
NC
C32 .1
U68 VCC 74HC367 GND
16
8
MOD_DATA_IN
MOD_ENABLE
MOD_DATA_CLK
MOD_DATA_LATCH
XMIT_EN*
MOD_DATA_OUT
BACKPLANE_ID
+5V_BOOT
SPARE
MODDATALCH
MODDATACLK
MOD_ENABLE
MODDATAIN
10-B8
J5-23
J5-21
J5-22
J5-27
J5-20
J5-25
J5-28
J5-33
J5-29
J5-31
J5-24
J5-26
J5-30
J5-10
J5-11
J5-32
J5-38

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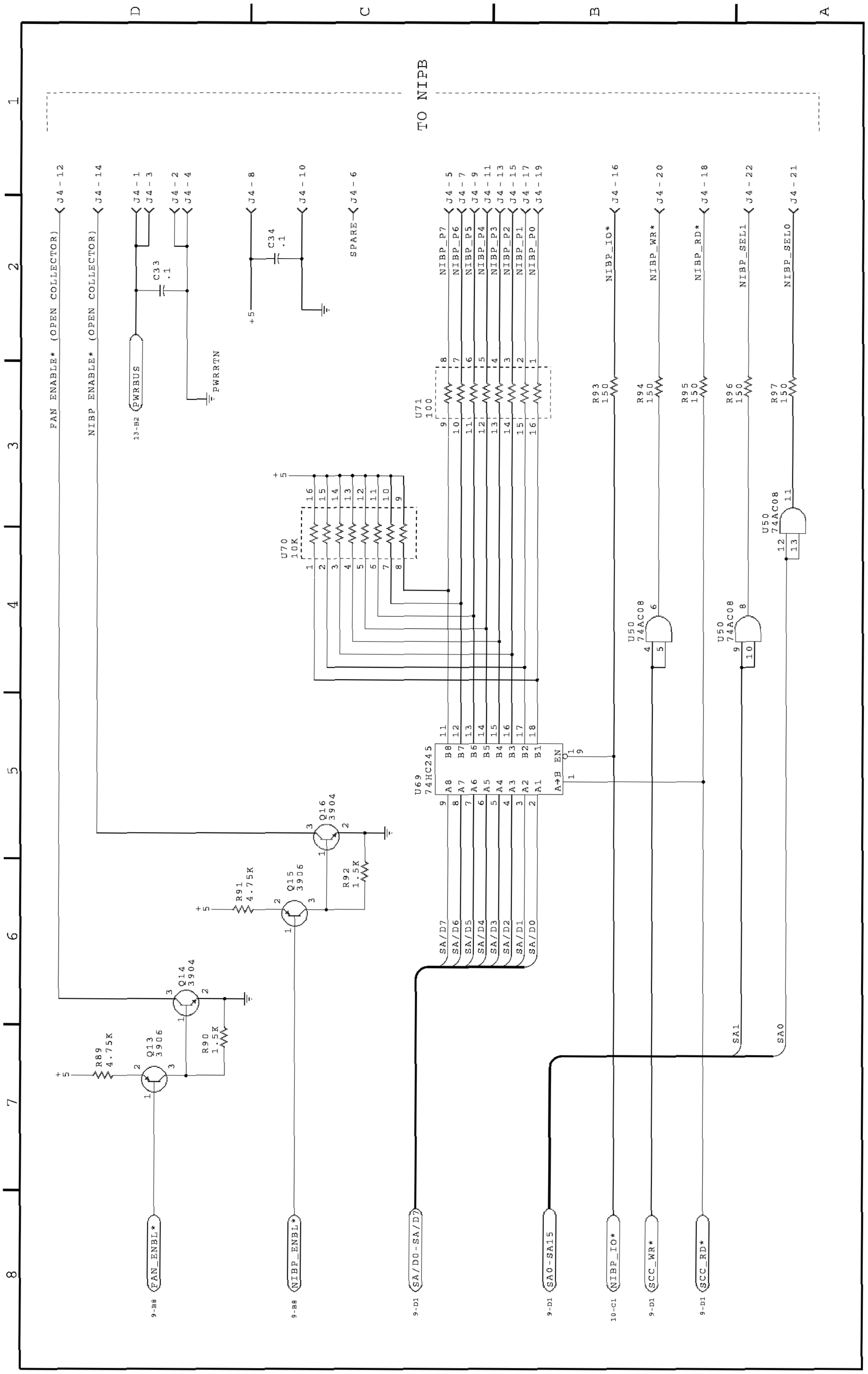
TO NIPB
FAN ENABLE* (OPEN COLLECTOR)
NIBP ENABLE* (OPEN COLLECTOR)
J4-12
J4-14
J4-1
J4-3
J4-2
J4-4
J4-8
J4-10
J4-6
SPARE
C33 .1
C34 .1
PWRBUS
PWRRTN
13-B2
+5
NIBP_P7
NIBP_P6
NIBP_P5
NIBP_P4
NIBP_P3
NIBP_P2
NIBP_P1
NIBP_P0
J4-5
J4-7
J4-9
J4-11
J4-13
J4-15
J4-17
J4-19
NIBP_IO*
NIBP_WR*
NIBP_RD*
NIBP_SEL1
NIBP_SEL0
J4-16
J4-20
J4-18
J4-22
J4-21
U71 100
R93 150
R94 150
R95 150
R96 150
R97 150
U70 10K
U50 74AC08
U69 74HC245
A→B EN
Q16 3904
Q15 3906
Q14 3904
Q13 3906
R91 4.75K
R92 1.5K
R89 4.75K
R90 1.5K
SA/D7
SA/D6
SA/D5
SA/D4
SA/D3
SA/D2
SA/D1
SA/D0
SA1
SA0
FAN_ENBL*
NIBP_ENBL*
SA/D0-SA/D7
SA0-SA15
NIBP_IO*
SCC_WR*
SCC_RD*
9-B8
9-B8
9-D1
9-D1
10-C1
9-D1
9-D1
A
B
C
D
1
2
3
4
5
6
7
8

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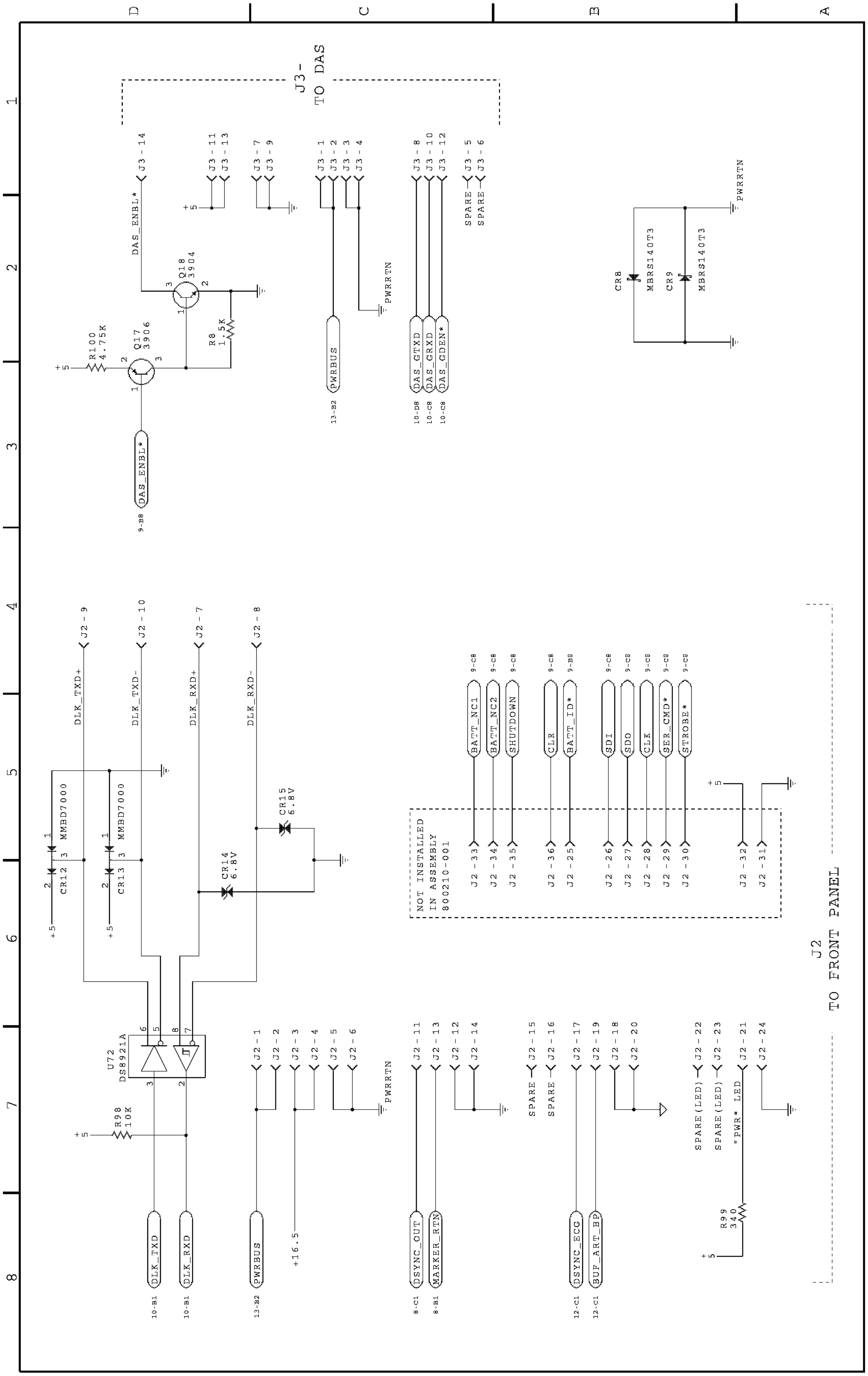
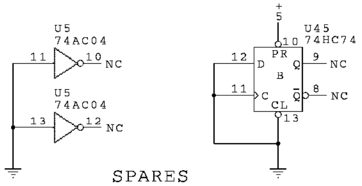

J3- TO DAS
J3 - 14
J3 - 11
J3 - 13
J3 - 7
J3 - 9
J3 - 1
J3 - 2
J3 - 3
J3 - 4
J3 - 8
J3 - 10
J3 - 12
J3 - 5
J3 - 6
SPARE
SPARE
PWRRTN
DAS_ENBL*
+5
Q18
3904
Q17
3906
R100
4.75K
R8
1.5K
PWRTN
PWRBUS
13-B2
DAS_GTXD
DAS_GRXD
DAS_GDEN*
10-D8
10-C8
10-C8
DAS_ENBL*
9-B8
CR8
MBRS140T3
CR9
MBRS140T3
J2 - 9
J2 - 10
J2 - 7
J2 - 8
DLK_TXD+
DLK_TXD-
DLK_RXD+
DLK_RXD-
CR12
MMBD7000
CR13
MMBD7000
CR14
6.8V
CR15
6.8V
BATT_NC1
BATT_NC2
SHUTDOWN
CLR
BATT_ID*
SDI
SDO
CLK
SER_CMD*
STROBE*
9-C8
9-B8
NOT INSTALLED
IN ASSEMBLY
800210-001
J2 -33
J2 -34
J2 -35
J2 -36
J2 -25
J2 -26
J2 -27
J2 -28
J2 -29
J2 -30
J2 -32
J2 -31
J2
TO FRONT PANEL
U72
DS8921A
R98
10K
J2 - 1
J2 - 2
J2 - 3
J2 - 4
J2 - 5
J2 - 6
J2 - 11
J2 - 13
J2 - 12
J2 - 14
J2 - 15
J2 - 16
J2 - 17
J2 - 19
J2 - 18
J2 - 20
J2 - 22
J2 - 23
J2 - 21
J2 - 24
SPARE
SPARE
SPARE(LED)
SPARE(LED)
"PWR" LED
R99
340
DLK_TXD
DLK_RXD
PWRBUS
+16.5
DSYNC_OUT
MARKER_RTN
DSYNC_ECG
BUP_ART_BP
10-B1
10-B1
13-B2
8-C1
8-B1
12-C1
12-C1
A
B
C
D
1
2
3
4
5
6
7
8

| IC POWER/RETURN CHART | | | | | | POWER SUPPLY | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| IC | | POWER | | RETURN | | BYPASS | | | | |
| U1 | 74HC541 | 20 | +5 | 10 | | C35 | .1 | | | |
| U2 | 5AC312 | 1,28 | +5 | 14,15 | | C36 | .1 | C37 | .1 | |
| U3 | 68HC000 | 14&52 | +5 | 16,17,56,57 | | C38 | .47 20% | C39 | .47 20% | |
| U4 | 5AC324 | 15,37 | +5 | 9,31 | | C40 | .22 20% | C41 | .22 20% | |
| U5 | 74AC04 | 14 | +5 | 7 | | C42 | .1 | | | |
| U6 | 74AC32 | 14 | +5 | 7 | | C43 | .1 | | | |
| U8 | 74ACQ245 | 20 | +5 | 10 | | C44 | .22 20% | | | |
| U9 | 74ACQ245 | 20 | +5 | 10 | | C45 | .22 20% | | | |
| U13 | DP8570 | 28 | +5 | 14 | | C46 | .1 | | | |
| U14 | 74AC32 | 14 | +5 | 7 | | C47 | .1 | | | |
| U16 | 28F020 | 32 | +5 | 16 | | C48 | .1 | | | |
| U17 | 28F020 | 32 | +5 | 16 | | C49 | .1 | | | |
| U18 | 28F020 | 32 | +5 | 16 | | C50 | .1 | | | NOT INSTALLED |
| U19 | 28F020 | 32 | +5 | 16 | | C51 | .1 | | | NOT INSTALLED |
| U20 | 628128L | 32 | +VBAT | 16 | | C52 | .1 | | | NOT INSTALLED |
| U21 | 628128L | 32 | +VBAT | 16 | | C53 | .1 | | | NOT INSTALLED |
| U22 | 628128L | 32 | +VBAT | 16 | | C54 | .1 | | | NOT INSTALLED |
| U23 | 628128L | 32 | +VBAT | 16 | | C55 | .1 | | | NOT INSTALLED |
| U24 | 628128L | 32 | +VBAT | 16 | | C56 | .1 | | | NOT INSTALLED |
| U25 | 628128L | 32 | +VBAT | 16 | | C57 | .1 | | | NOT INSTALLED |
| U26 | 74AC32 | 14 | +VBAT | 7 | | C58 | .1 | | | NOT INSTALLED |
| U27 | 628128L | 32 | +VBAT | 16 | | C59 | .1 | | | NOT INSTALLED |
| U28 | 628128L | 32 | +VBAT | 16 | | C60 | .1 | | | NOT INSTALLED |
| U29 | 628128L | 32 | +VBAT | 16 | | C61 | .1 | | | |
| U30 | 628128L | 32 | +VBAT | 16 | | C62 | .1 | | | |
| U31 | 628128L | 32 | +VBAT | 16 | | C63 | .1 | | | |
| U32 | 628128L | 32 | +VBAT | 16 | | C64 | .1 | | | |
| U33 | 74AC32 | 14 | +VBAT | 7 | | C65 | .1 | | | |
| U34 | 7134LA | 52 | +5 | 26 | | C66 | .22 20% | | | NOT INSTALLED |
| U35 | 7134LA | 52 | +5 | 26 | | C67 | .22 20% | | | NOT INSTALLED |
| U36 | 7134LA | 52 | +5 | 26 | | C68 | .22 20% | | | |
| U37 | 71342LA SEMAPHORE RAM | 52 | +5 | 26 | GND | C69 | .22 20% | | | |
| U40 | 74HC245 | 20 | +5 | 10 | | C70 | .22 20% | | | |
| U43 | 74HC541 | 20 | +5 | 10 | | C71 | .22 20% | | | |
| U44 | CLK OSC 14.7456MHz | 4 | +5 | 2 | GND | C72 | .1 | C100 | .001 5% | |
| U45 | 74HC74 | 14 | +5 | 7 | | C73 | .1 | C102 | .001 5% | |
| U46 | 74AC253 | 16 | +5 | 8 | | C74 | .1 | C101 | .001 5% | |
| U47 | 74HC541 | 20 | +5 | 10 | | C75 | .22 20% | | | |
| U48 | 80C152JB -1 | 2 | +5 | 3,33 | GND | C76 | .47 20% | | | |
| U49 | 74HC573 | 20 | +5 | 10 | | C77 | .22 20% | | | |
| U50 | 74AC08 | 14 | +5 | 7 | | C78 | .1 | | | |
| U51 | HM62256 -120 OR -150 | 28 | +5 | 14 | GND | C79 | .1 | | | |
| U52 | 27C256 -150nS | 32 | +5 | 16 | GND | C80 | .1 | | | |
| U54 | 5AC324 | 15,37 | +5 | 9,31 | | C81 | .22 20% | C82 | .22 20% | |
| U55 | 74HC154 | 24 | +5 | 12 | | C83 | .1 | | | |
| U56 | 74AC32 | 14 | +5 | 7 | | C84 | .1 | | | |
| U57 | 74HC595 | 16 | +5 | 8 | | C85 | .1 | | | |
| U58 | 74HC595 | 16 | +5 | 8 | | C86 | .1 | | | |
| U59 | 74HC165 | 16 | +5 | 8 | | C87 | .1 | | | |
| U60 | 74HC165 | 16 | +5 | 8 | | C88 | .1 | | | |
| U61 | 74HC165 | 16 | +5 | 8 | | C89 | .1 | | | |
| U62 | 74HC165 | 16 | +5 | 8 | | C90 | .1 | | | |
| U63 | MAX695 | 3 | +5 | 4 | | C91 | .1 | | | |
| U64 | 74HC273 | 20 | +5 | 10 | | C92 | .1 | | | |
| U65 | 74HC273 | 20 | +5 | 10 | | C93 | .1 | | | |
| U66 | 74HC04 | 14 | +5 | 7 | | C94 | .1 | | | |
| U69 | 74HC245 | 20 | +5 | 10 | | C95 | .22 20% | | | |
| U72 | DS8921A | 1 | +5 | 4 | | C96 | .1 | | | |
| U73 | 74AC32 | 14 | +5 | 7 | | C98 | .1 | | | |



SPARES

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| REFDES | PAGE COORDINATES |
|---|---|
| U1: | 1-D7 |
| U10: | 2-D4 |
| U11: | 2-C4 |
| U12: | 2-D2 |
| U13: | 2-B4 |
| U14: | 3-D7<br>7-A4,A5 |
| U15: | 3-D3 |
| U16: | 3-C6 |
| U17: | 3-B6 |
| U18: | 3-C3 |
| U19: | 3-B3 |
| U2: | 1-B7 |
| U20: | 4-D6 |
| U21: | 4-C6 |
| U22: | 4-D4 |
| U23: | 4-C4 |
| U24: | 4-D2 |
| U25: | 4-C2 |
| U26: | 4-B8 |
| U27: | 5-D6 |
| U28: | 5-C6 |
| U29: | 5-D4 |
| U3: | 1-D5 |
| U30: | 5-C4 |
| U31: | 5-D2 |
| U32: | 5-C2 |
| U33: | 5-B8 |
| U34: | 6-D7 |
| U35: | 6-B7 |
| U36: | 6-D3 |
| U37: | 6-C3 |
| U38: | 7-B7,C7,D7 |
| U39: | 7-C6 |
| U4: | 1-D3 |
| U40: | 7-D4 |
| U41: | 7-B7,C7,D7 |
| U43: | 7-B4 |
| U44: | 8-D8 |
| U45: | 8-D8 |
| U46: | 8-D7 |

| REFDES | PAGE COORDINATES |
|---|---|
| U47: | 8-B5 |
| U48: | 9-D7 |
| U49: | 9-B4 |
| U5: | 1-B3,D2<br>7-C2,D2 |
| U50: | 9-C5<br>14-A4,B4 |
| U51: | 9-D3 |
| U52: | 9-C3 |
| U53: | 9-B3 |
| U54: | 10-B6 |
| U55: | 10-D4 |
| U56: | 10-C2,D2 |
| U57: | 11-D7 |
| U58: | 11-C7 |
| U59: | 11-D5 |
| U6: | 1-B2 |
| U60: | 11-D4 |
| U61: | 11-D3 |
| U62: | 11-D2 |
| U63: | 11-B5 |
| U64: | 12-D6 |
| U65: | 12-C6 |
| U66: | 10-D3<br>12-A6,A7,B5,B6,D5 |
| U67: | 12-D4 |
| U68: | 13-B7,D4 |
| U69: | 14-C5 |
| U7: | 2-D7 |
| U70: | 14-C4 |
| U71: | 14-C3 |
| U72: | 15-D7 |
| U73: | 10-C2<br>12-C7,D7 |
| U8: | 2-C7 |
| U9: | 2-B7 |

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| CONN | LABEL |
|---|---|
| J1-12: | GND |
| J1-17: | PWRRTN |
| J1-18: | PWRBUS |
| J1-19: | PWRRTN |
| J1-20: | PWRBUS |
| J1-22: | GND |
| J1-24: | GND |
| J1-26: | GND |
| J1-27: | 07081019 |
| J1-28: | 07011007 |
| J1-29: | 07081020 |
| J1-30: | 07011010 |
| J1-31: | GND |
| J1-32: | 07011012 |
| J1-33: | GND |
| J1-34: | 07011015 |
| J1-35: | 07081023 |
| J1-36: | 07011017 |
| J1-37: | GND |
| J1-38: | 07011020 |
| J1-39: | GND |
| J1-4: | GND |
| J1-40: | 07011022 |
| J1-41: | 07081026 |
| J1-42: | 07011025 |
| J1-43: | 07081027 |
| J1-44: | MINX_IRQ* |
| J1-45: | 07011036 |
| J1-46: | 07062061 |
| J1-47: | 07011038 |
| J1-48: | 07011053 |
| J1-49: | 07011041 |
| J1-50: | 07057065 |
| J1-51: | 07011043 |
| J1-53: | 07011046 |
| J1-54: | 07081044 |
| J1-55: | 07011048 |
| J1-57: | 07011051 |
| J1-58: | +5.0 |
| J1-59: | 5VAGND |
| J1-6: | GND |
| J1-60: | -5.0 |
| J1-61: | +5 |
| J1-62: | +5 |
| J1-63: | GND |
| J1-64: | GND |
| J1-8: | GND |

| CONN | LABEL |
|---|---|
| J2-1: | PWRBUS |
| J2-10: | 15029013 |
| J2-11: | DSYNC_OUT |
| J2-12: | GND |
| J2-13: | MARKER_RTN |
| J2-14: | GND |
| J2-17: | DSYNC_ECG |
| J2-18: | AGND |
| J2-19: | BUF_ART_BP |
| J2-2: | PWRBUS |
| J2-20: | AGND |
| J2-21: | 15016058 |
| J2-24: | GND |
| J2-25: | BATT_ID* |
| J2-26: | SDI |
| J2-27: | SDO |
| J2-28: | CLK |
| J2-29: | SER_CMD* |
| J2-3: | +16.5 |
| J2-30: | STROBE* |
| J2-31: | GND |
| J2-32: | +5 |
| J2-33: | BATT_NC1 |
| J2-34: | BATT_NC2 |
| J2-35: | SHUTDOWN |
| J2-36: | CLR |
| J2-4: | +16.5 |
| J2-5: | PWRRTN |
| J2-6: | PWRRTN |
| J2-7: | 15029014 |
| J2-8: | 15029015 |
| J2-9: | 15029012 |
| J3-1: | PWRBUS |
| J3-10: | DAS_GRXD |
| J3-11: | +5 |
| J3-12: | DAS_GDEN* |
| J3-13: | +5 |
| J3-14: | 15086011 |
| J3-2: | PWRBUS |
| J3-3: | PWRRTN |
| J3-4: | PWRRTN |
| J3-7: | GND |
| J3-8: | DAS_GTXD |
| J3-9: | GND |

| CONN | LABEL |
|---|---|
| J4-1: | PWRBUS |
| J4-10: | GND |
| J4-11: | 14082038 |
| J4-12: | 14031005 |
| J4-13: | 14082039 |
| J4-14: | 14044008 |
| J4-15: | 14082040 |
| J4-16: | 14080048 |
| J4-17: | 14082041 |
| J4-18: | 14080055 |
| J4-19: | 14082042 |
| J4-2: | PWRRTN |
| J4-20: | 14080052 |
| J4-21: | 14080062 |
| J4-22: | 14080059 |
| J4-3: | PWRBUS |
| J4-4: | PWRRTN |
| J4-5: | 14082035 |
| J4-7: | 14082036 |
| J4-8: | +5 |
| J4-9: | 14082037 |
| J5-1: | ART_BP |
| J5-12: | AGND |
| J5-13: | -12.8 |
| J5-14: | AGND |
| J5-15: | +12.8 |
| J5-16: | +5.0 |
| J5-17: | 5VAGND |
| J5-18: | -5.0 |
| J5-19: | 5VAGND |
| J5-2: | SYNCECGRTN |
| J5-20: | 13009032 |
| J5-21: | 13009020 |
| J5-22: | 13009022 |
| J5-23: | 13009017 |
| J5-24: | GND |
| J5-25: | 13009034 |
| J5-26: | GND |
| J5-27: | 13009025 |
| J5-28: | BKPLANE_ID |
| J5-29: | +5 |
| J5-3: | BP2 |
| J5-30: | 13009054 |
| J5-31: | +5 |
| J5-33: | +15.5 |
| J5-34: | PWRRTN |
| J5-35: | PWRRTN |
| J5-36: | +16.5 |
| J5-37: | +16.5 |
| J5-39: | PWRBUS |
| J5-4: | SYNC_ECG |
| J5-40: | PWRBUS |
| J5-5: | BP3 |
| J5-6: | BP4 |
| J5-7: | TRC2/ECGI |
| J5-8: | TRC1/ECGII |
| J5-9: | RESP/ECGV |

# 28

# NBP PCB

# PN 800316

**General** .......................................................................... **28-2**

**Parts Location Diagram PN 800316-002A** ........................................ **28-3**

**Parts List PN 800316-002A** ............................................................ **28-5**

**Schematic Diagram PN SD800316-002A** .......................................... **28-7**

**Parts Location Diagram PN 800316-001C** ........................................ **28-9**

**Parts List PN 800316-001C** .......................................................... **28-10**

**Schematic Diagram PN SD800316-001C** ........................................ **28-12**

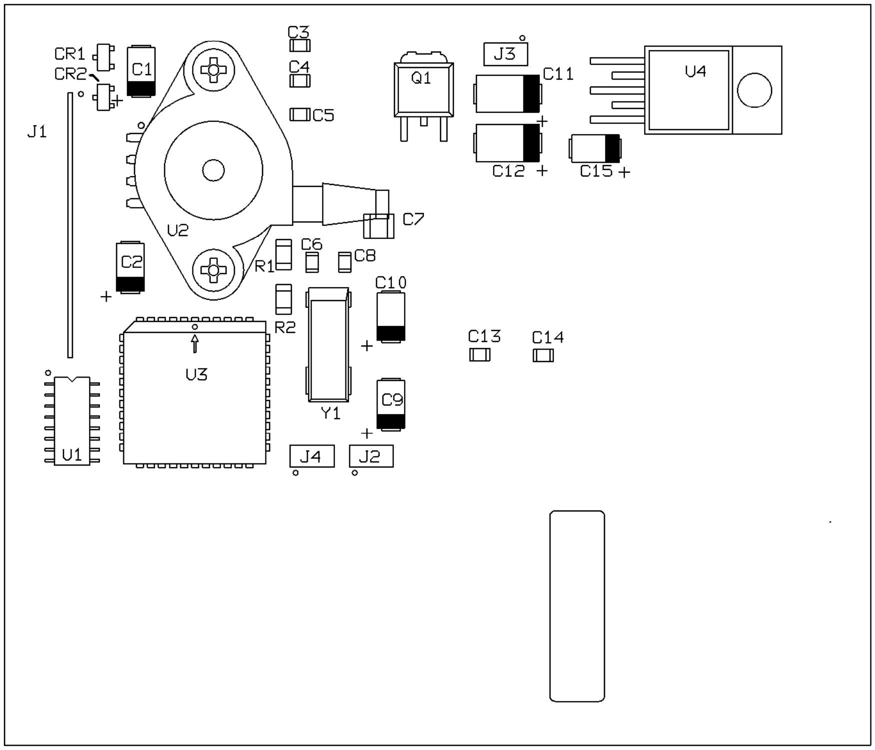
# General

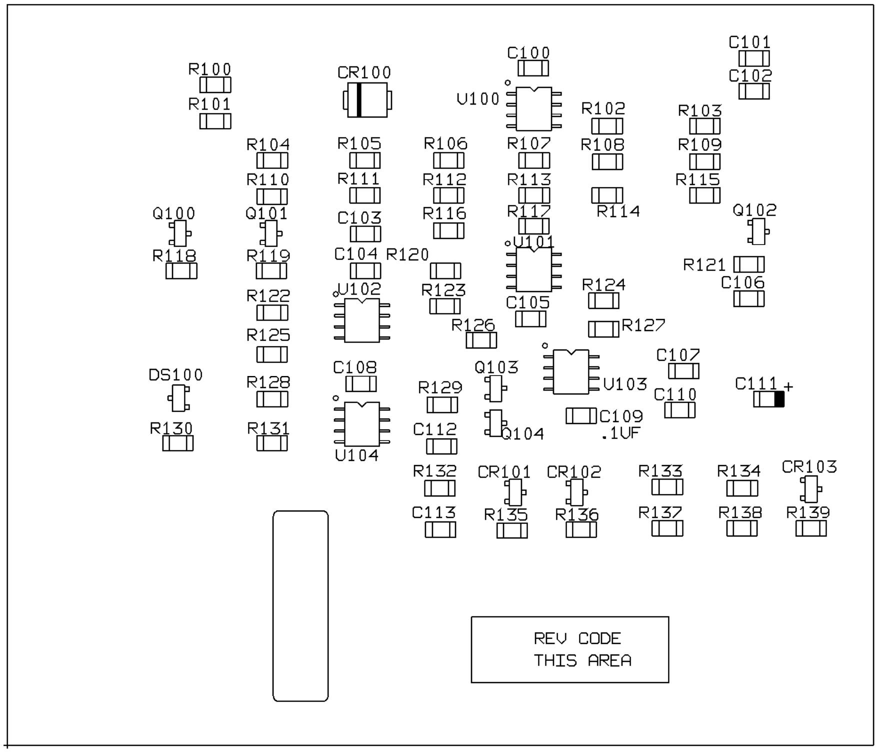
There are two different versions of the NBP PCB:

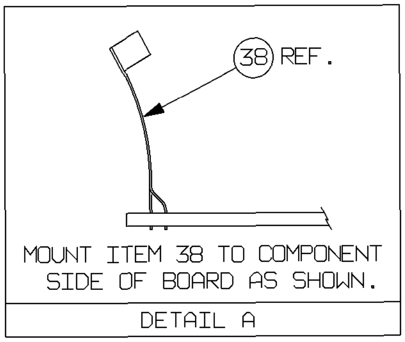
- pn 800316-001, was used first in all modules; and
- pn 800210-002, replaced the first version of the PCB.

**NOTE**
You may replace version -001 or -002 circuit board with a -002 circuit board, but do not replace a -002 with a -001 circuit board.

# Parts Location Diagram PN 800316-002A

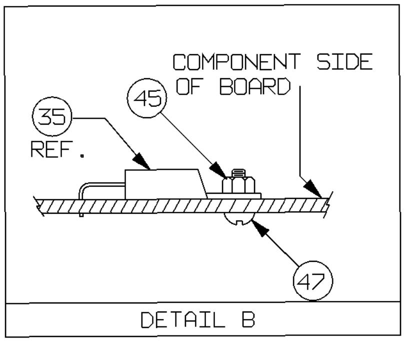

C3
CR1
C1
C4
CR2
Q1
J3
C11
U4
C5
J1
C12
C15
C7
U2
C6
C8
R1
C2
C10
R2
C13
C14
U3
C9
Y1
U1
J4
J2


C101
C100
R100
CR100
C102
U100
R101
R102
R103
R104
R105
R106
R107
R108
R109
R110
R111
R112
R113
R115
R114
Q100
Q101
C103
R116
R117
Q102
U101
R118
R119
C104
R120
R121
C106
U102
R124
R122
R123
C105
R126
R127
R125
C107
DS100
C108
Q103
U103
C111
R128
R129
C110
C109
.1UF
R130
R131
C112
Q104
U104
R132
CR101
CR102
R133
R134
CR103
C113
R135
R136
R137
R138
R139
REV CODE
THIS AREA

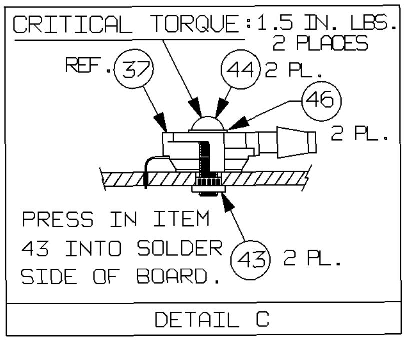


MOUNT ITEM 38 TO COMPONENT SIDE OF BOARD AS SHOWN.

DETAIL A


COMPONENT SIDE OF BOARD
45
35
REF.
47

DETAIL B



CRITICAL TORQUE: 1.5 IN. LBS. 2 PLACES

REF.
37
44
2 PL.
46
2 PL.
43
2 PL.

PRESS IN ITEM 43 INTO SOLDER SIDE OF BOARD.

DETAIL C

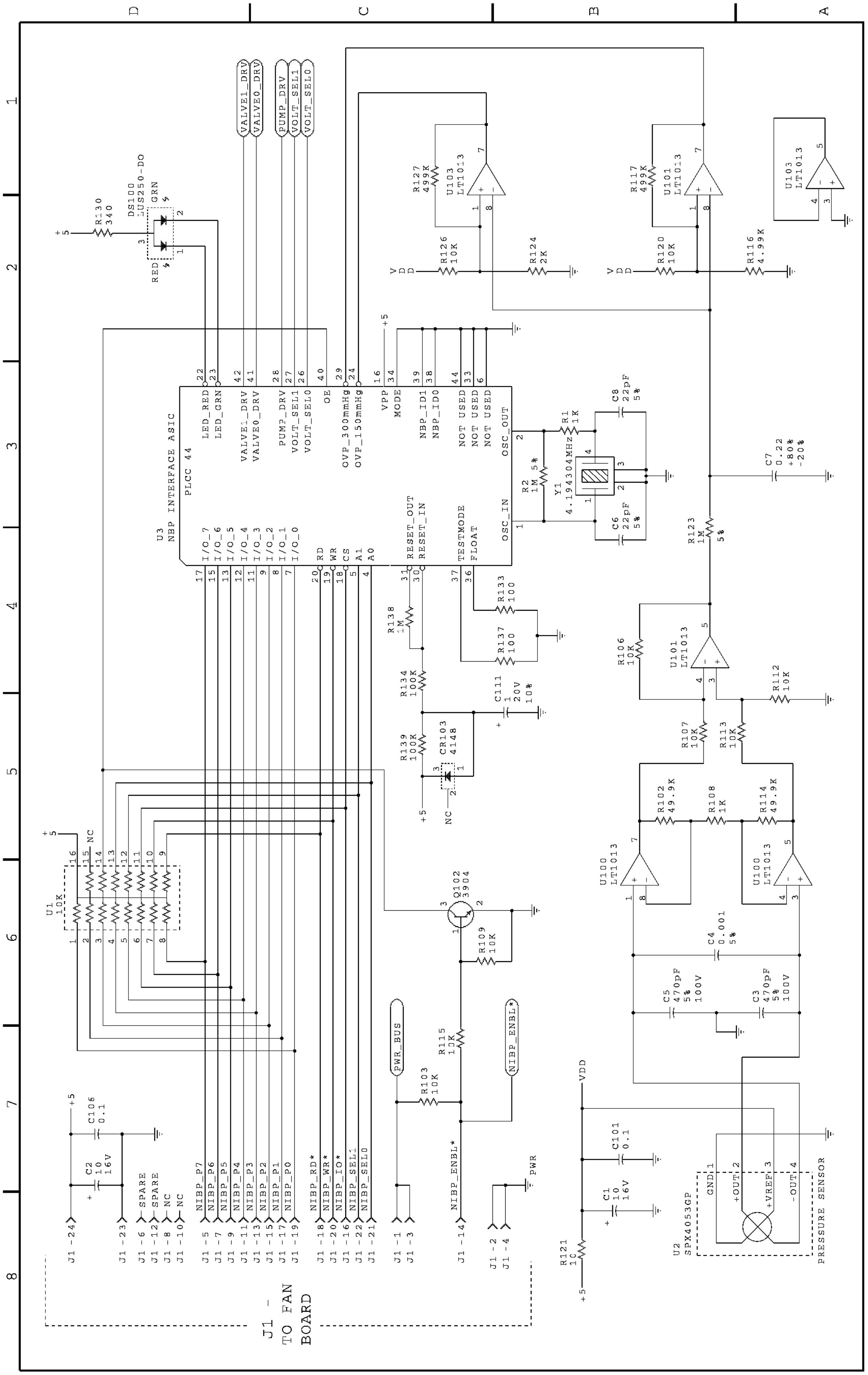
# Parts List PN 800316-002A

| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| C1, 2 | Cap, Tant, 1µF, 20%, 10V, SM | 1176-106 | 2 |
| C3, 5 | Cap, Cer, 470pF, 5%, 50V, SM | 1181-471 | 2 |
| C4 | Cap, Cer, 0.001µF, 5%, 50V, SM | 1181-102 | 1 |
| C6, 8 | Cap, Cer, 22pF, 5%, 50V, SM | 1181-220 | 2 |
| C7 | Cap, Cer, 0.22µF, 20%, 50V, SM | 1187-224 | 1 |
| C9, 10, 15 | Cap, Tant, 4.7µF, 20%, 20V, SM | 402004-001 | 3 |
| C11, 12 | Cap, Tant, 22µF, 10%, 25V, SM | 407653-001 | 2 |
| C13, 14 | Cap, Cer, 0.01µF, 5%, 50V, SM | 1182-103 | 2 |
| C100-110, 112, 113 | Cap, Cer, 0.1µF, 20%, 50V | 404370-001 | 13 |
| C111 | Cap, Tant, 1µF, 10%, 16V, SM | 403253-001 | 1 |
| CR1, 2 | Diode, Schottky, SM BAT54 | 401985-001 | 2 |
| CR100 | Diode, Schottky, Barrier, 1A, 40V, SM MBRS140T3 | 403187-001 | 1 |
| CR101-103 | Diode, SM MMAD4148 | 401980-001 | 3 |
| DS1 | Diode, Light-Emitting (Red/Green) LDGR 2340 | 402428-001 | 1 |
| J1 | Flex Circuit Assembly, NBP | 404744-001 | 1 |
| J2, 3, 4 | PC Post | 1778-604 | 6 |
| Q1 | Transistor, MOSFET, N-Channel, SM 25N05 | 407659-001 | 1 |
| Q100-104 | Transistor, NPN, SM T3904 | 2511-001 | 5 |
| R1, 108, 111, 135, 136 | Res, Cer, 1K, 1%, 1/8W, SM | 1082-103 | 5 |
| R2, 123 | Res, Cer, 1M, 5%, 1/8W, SM | 1081-105 | 2 |
| R3 | Res, Cer, 2.74K, 1%, 1/8W, SM | 1082-823 | 1 |
| R4 | Res, Cer, 3.01K, 1%, 1/8W, SM | 1082-821 | 1 |
| R100 | Res, 340Ω, 1%, 1/8W, SM | 1082-790 | 1 |
| R102, 114 | Res, Cer, 49.9K, 1%, 1/8W, SM | 1082-498 | 2 |
| R103, 104, 106, 107, 109, 112, 113, 115, 118-120, 126 | Res, Cer, 10K, 1%, 1/8W, SM | 1082-104 | 12 |
| R105, 121 | Res, Cer, 10Ω, 1%, 1/8W, SM | 1082-786 | 2 |
| R110 | Res, Cer, 6.34K, 1%, 1/8W, SM | 1082-822 | 1 |
| R116 | Res, Cer, 4.99K, 10%, 1/4W, SM | 1082-101 | 1 |
| R117, 127 | Res, Cer, 499K, 1%, 1/8W, SM | 1082-499 | 2 |
| R122, 128, 134, 139 | Res, Cer, 100K, 1%, 1/8W, SM | 1082-100 | 4 |
| R124 | Res, Cer, 2.00K, 10%, 1/4W, SM | 1082-201 | 1 |
| R125, 131 | Res, Cer, 11.5K, 1%, 1/8W, SM | 1082-815 | 2 |
| R129, 132 | Res, Cer, 51.1Ω, 10%, 1/4W, SM | 1082-789 | 2 |
| R133, 137 | Res, Cer, 100Ω, 1%, 1/8W, SM | 1082-755 | 2 |
| R138 | Res, Cer, 1M, 1%, 1/8W, SM | 1082-828 | 1 |
| U1 | Res Ntwk, 10K | 1061-103 | 1 |
| U2 | Sensor, Pressure, 7.3PSI, Compensated | 404406-004 | 1 |
| U3 | FPGA, Programmed, NBP, PLCC | 414521-001 | 1 |
| U4 | Volt Rgltr, Adj, TO220 LM2941CT | 403609-001 | 1 |

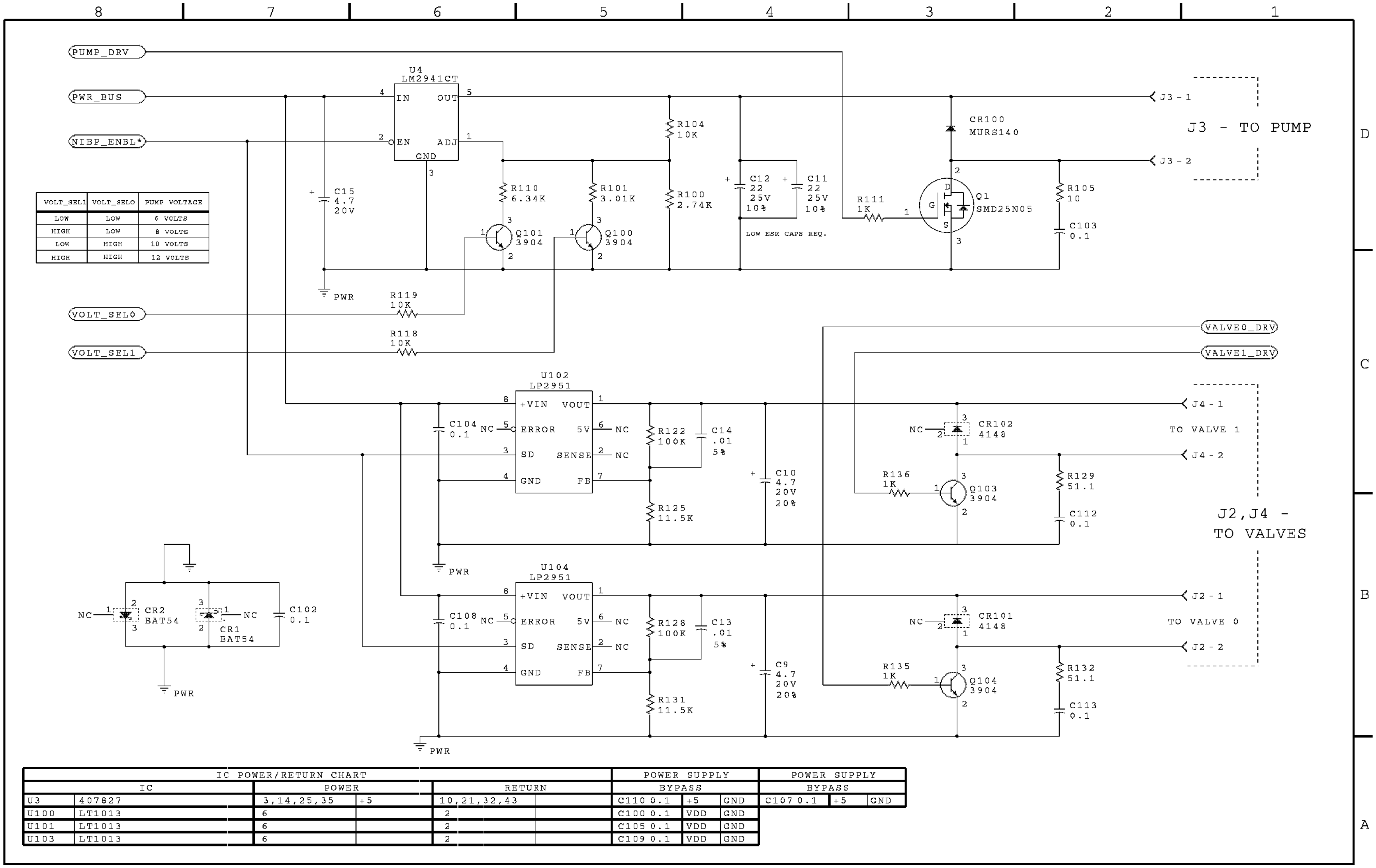
| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| U102, 104 | Volt Rgltr, Adj, SM LP2951A | 3076-001 | 2 |
| U100-103 | Operation Ampl, SM LT1013 | 3137-013 | 3 |
| Y1 | Crystal, 4.194304MHz, SM | 407658-001 | 1 |
| - | Insert, Threaded, 4-40 | 404158-001 | 2 |
| - | Nut, ESNA, 4-40 | 4521-304 | 1 |
| - | Screw, PNH, Phillips, 4-40 x 5/16 (for U4) | 4502-410 | 1 |
| - | Screw, PNH, Phillips, 4-40 x 1/2 (for U2) | 45000-408 | 2 |
| - | Washer, Flat, SST, No 4 (for U2, 4) | 4520-004 | 2 |
| - | Circuit Board | 800317-002A | 1 |
| - | Schematic Diagram | SD800316-002A | - |

# Schematic Diagram PN SD800316-002A

1 of 2


D
C
B
A
1
2
3
4
5
6
7
8
U3
NBP INTERFACE ASIC
PLCC 44
LED_RED
LED_GRN
VALVE1_DRV
VALVE0_DRV
PUMP_DRV
VOLT_SEL1
VOLT_SEL0
OE
OVP_300mmHg
OVP_150mmHg
VPP
MODE
NBP_ID1
NBP_ID0
NOT USED
OSC_OUT
OSC_IN
I/O_7
I/O_6
I/O_5
I/O_4
I/O_3
I/O_2
I/O_1
I/O_0
RD
WR
CS
A1
A0
RESET_OUT
RESET_IN
TESTMODE
FLOAT
DS100
LUS250-DO
GRN
RED
R130
340
+5
R127
499K
U103
LT1013
R126
10K
R124
2K
VDD
R117
499K
U101
LT1013
R120
10K
R116
4.99K
R1
1K
C8
22pF
5%
R2
1M 5%
Y1
4.194304MHz
C6
22pF
5%
C7
0.22
+80%
-20%
R123
1M
5%
R133
100
R137
100
R138
1M
R134
100K
C111
1
20V
10%
R139
100K
CR103
4148
NC
R106
10K
R112
10K
R107
10K
R113
10K
R102
49.9K
R108
1K
R114
49.9K
U100
LT1013
C4
0.001
5%
C5
470pF
5%
100V
C3
470pF
5%
100V
U1
10K
Q102
3904
R109
10K
R115
1.5K
R103
10K
PWR_BUS
NIBP_ENBL*
C106
0.1
C2
10
16V
SPARE
NIBP_P7
NIBP_P6
NIBP_P5
NIBP_P4
NIBP_P3
NIBP_P2
NIBP_P1
NIBP_P0
NIBP_RD*
NIBP_WR*
NIBP_IO*
NIBP_SEL1
NIBP_SEL0
PWR
J1 - TO FAN BOARD
C101
0.1
C1
10
16V
R121
10
U2
SPX4053GP
GND
+OUT
+VREF
-OUT
PRESSURE SENSOR

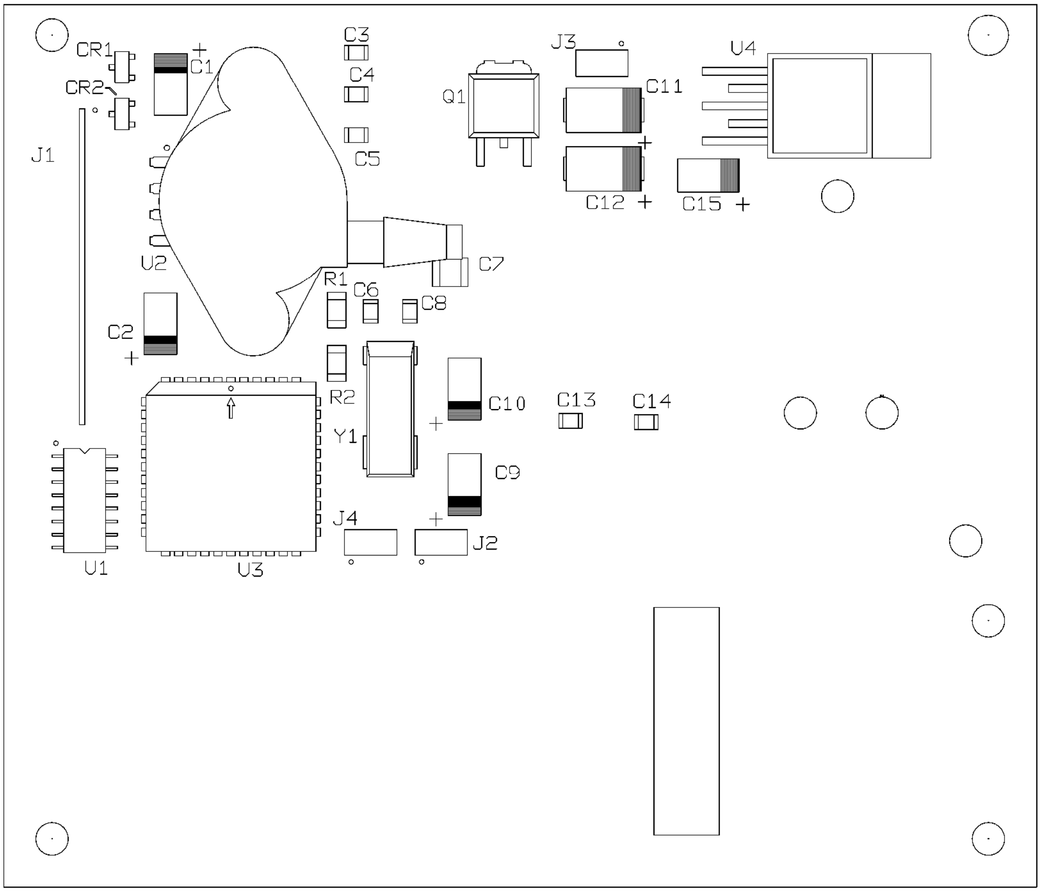
## 2 of 2


8
7
6
5
4
3
2
1
D
C
B
A
PUMP_DRV
PWR_BUS
NIBP_ENBL*
VOLT_SEL0
VOLT_SEL1
U4
LM2941CT
IN
OUT
EN
ADJ
GND
C15
4.7
20V
PWR
R110
6.34K
R101
3.01K
Q101
3904
Q100
3904
R104
10K
R100
2.74K
C12
22
25V
10%
C11
22
25V
10%
LOW ESR CAPS REQ.
R119
10K
R118
10K
R111
1K
CR100
MURS140
Q1
SMD25N05
R105
10
C103
0.1
J3 - 1
J3 - 2
J3 - TO PUMP
VALVE0_DRV
VALVE1_DRV
U102
LP2951
+VIN
VOUT
ERROR
5V
SD
SENSE
GND
FB
NC
C104
0.1
R122
100K
C14
.01
5%
R125
11.5K
C10
4.7
20V
20%
CR102
4148
R136
1K
Q103
3904
R129
51.1
C112
0.1
J4 - 1
TO VALVE 1
J4 - 2
J2,J4 -
TO VALVES
U104
LP2951
C108
0.1
R128
100K
C13
.01
5%
R131
11.5K
C9
4.7
20V
20%
CR101
4148
R135
1K
Q104
3904
R132
51.1
C113
0.1
J2 - 1
TO VALVE 0
J2 - 2
CR2
BAT54
CR1
BAT54
C102
0.1

| VOLT_SEL1 | VOLT_SEL0 | PUMP VOLTAGE |
|---|---|---|
| LOW | LOW | 6 VOLTS |
| HIGH | LOW | 8 VOLTS |
| LOW | HIGH | 10 VOLTS |
| HIGH | HIGH | 12 VOLTS |

| IC POWER/RETURN CHART | | | | | | POWER SUPPLY | | | POWER SUPPLY | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| IC | | POWER | | RETURN | | BYPASS | | | BYPASS | | |
| U3 | 407827 | 3,14,25,35 | +5 | 10,21,32,43 | | C110 0.1 | +5 | GND | C107 0.1 | +5 | GND |
| U100 | LT1013 | 6 | | 2 | | C100 0.1 | VDD | GND | | | |
| U101 | LT1013 | 6 | | 2 | | C105 0.1 | VDD | GND | | | |
| U103 | LT1013 | 6 | | 2 | | C109 0.1 | VDD | GND | | | |

# Parts Location Diagram PN 800316-001C


CR1
CR2
C1
+
C3
C4
C5
Q1
J3
C11
+
U4
J1
C12 +
C15 +
U2
C7
R1
C6
C8
C2
+
R2
Y1
C10
+
C13
C14
C9
J4
+
J2
U1
U3

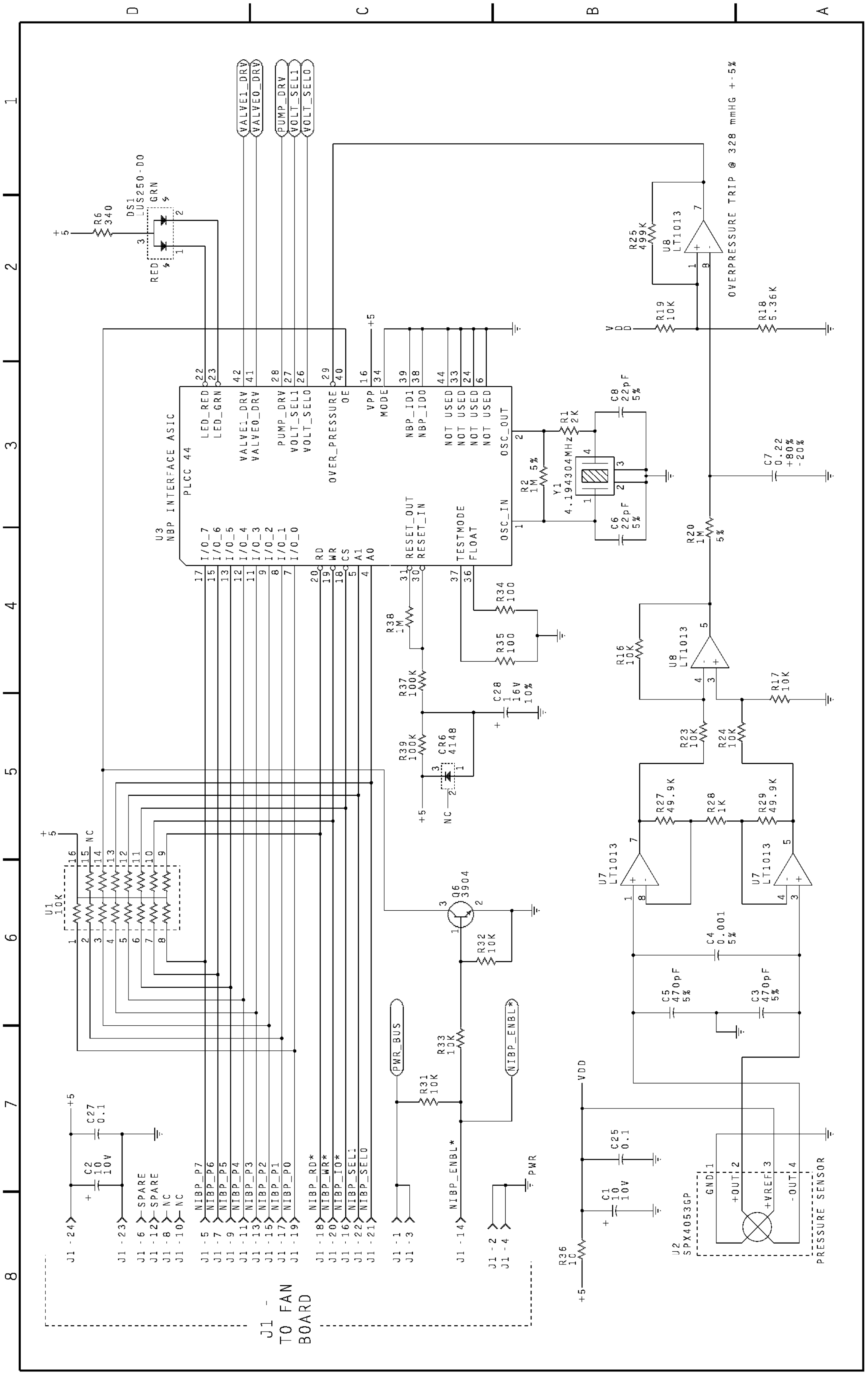
# Parts List PN 800316-001C

| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| C1, 2 | Cap, Tant, 1µF, 20%, 10V, SM | 1176-106 | 2 |
| C3, 5 | Cap, Cer, 470pF, 5%, 50V, SM | 1181-471 | 2 |
| C4 | Cap, Cer, 0.001µF, 5%, 50V, SM | 1181-102 | 1 |
| C6, 8 | Cap, Cer, 22pF, 5%, 50V, SM | 1181-220 | 2 |
| C7 | Cap, Cer, 0.22µF, 20%, 50V, SM | 1187-224 | 1 |
| C9, 10, 15 | Cap, Tant, 4.7µF, 20%, 20V, SM | 402004-001 | 3 |
| C11, 12 | Cap, Tant, 22µF, 10%, 25V, SM | 407653-001 | 2 |
| C13, 14 | Cap, Cer, 0.01µF, 5%, 50V, SM | 1182-103 | 2 |
| C16 - 27 | Cap, Cer, 0.1µF, 20%, 50V | 404370-001 | 12 |
| C28 | Cap, Tant, 1µF, 10%, 16V, SM | 403253-001 | 1 |
| CR1, 2 | Diode, Schottky, SM BAT54 | 401985-001 | 2 |
| CR3 | Diode, Schottky, Barrier, 1A, 40V, SM MBRS140T3 | 403187-001 | 1 |
| CR4, 5, 6 | Diode, SM MMAD4148 | 401980-001 | 3 |
| DS1 | Diode, Light-Emitting (Red/Green) LDGR 2340 | 402428-001 | 1 |
| J1 | Flex Circuit Assembly, NBP | 404744-001 | 1 |
| J2, 3, 4 | PC Post | 1778-604 | 6 |
| Q1 | Transistor, MOSFET, N-Channel, SM 25N05 | 407659-001 | 1 |
| Q2 - 6 | Transistor, NPN, SM T3904 | 2511-001 | 5 |
| R1, 15, 26, 28, 30 | Res, Cer, 1K, 1%, 1/8W, SM | 1082-103 | 5 |
| R2, 20 | Res, Cer, 1M, 5%, 1/8W, SM | 1081-105 | 2 |
| R3 | Res, Cer, 2.74K, 1%, 1/8W, SM | 1082-823 | 1 |
| R4 | Res, Cer, 3.01K, 1%, 1/8W, SM | 1082-821 | 1 |
| R5, 7, 9, 16, 17, 19, 23, 24, 31, 32, 33 | Res, Cer, 10K, 1%, 1/8W, SM | 1082-104 | 11 |
| R6 | Res, 340Ω, 1%, 1/8W, SM | 1082-790 | 1 |
| R8 | Res, Cer, 6.34K, 1%, 1/8W, SM | 1082-822 | 1 |
| R10, 12, 37, 39 | Res, Cer, 100K, 1%, 1/8W, SM | 1082-100 | 4 |
| R11, 13 | Res, Cer, 11.5K, 1%, 1/8W, SM | 1082-815 | 2 |
| R14, 36 | Res, Cer, 10Ω, 1%, 1/8W, SM | 1082-786 | 2 |
| R18 | Res, Cer, 5.36K, 1%, 1/8W, SM | 1082-785 | 1 |
| R21, 22 | Res, Cer, 51.1Ω, 10%, 1/4W, SM | 1082-789 | 2 |
| R25 | Res, Cer, 499K, 1%, 1/8W, SM | 1082-499 | 1 |
| R27, 29 | Res, Cer, 49.9K, 1%, 1/8W, SM | 1082-498 | 2 |
| R34, 35 | Res, Cer, 100Ω, 1%, 1/8W, SM | 1082-755 | 2 |
| R38 | Res, Cer, 1M, 1%, 1/8W, SM | 1082-828 | 1 |
| U1 | Res Ntwk, 10K | 1061-103 | 1 |
| U2 | Sensor, Pressure, 7.3PSI, Compensated | 404406-004 | 1 |
| U3 | FPGA, Programmed, NBP, PLCC | 407827-001 | 1 |
| U4 | Volt Rgltr, Adj, TO220 LM2941CT | 403609-001 | 1 |
| U5, 6 | Volt Rgltr, Adj, SM LP2951A | 3076-001 | 2 |
| U7, 8 | Operation Ampl, SM LT1013 | 3137-013 | 2 |

| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| Y1 | Crystal, 4.194304MHz, SM | 407658-001 | 1 |
| - | Insert, Threaded, 4-40 | 404158-001 | 3 |
| - | Screw, PNH, Phillips, 4-40 x 1/4 (for U4) | 45000-404 | 1 |
| - | Screw, PNH, Phillips, 4-40 x 1/2 (for U2) | 45000-408 | 2 |
| - | Washer, Flat, SST, No 4 (for U2, 4) | 4520-004 | 3 |
| - | Circuit Board | 800317-001C | 1 |
| - | Schematic Diagram | SD800316-001C | - |

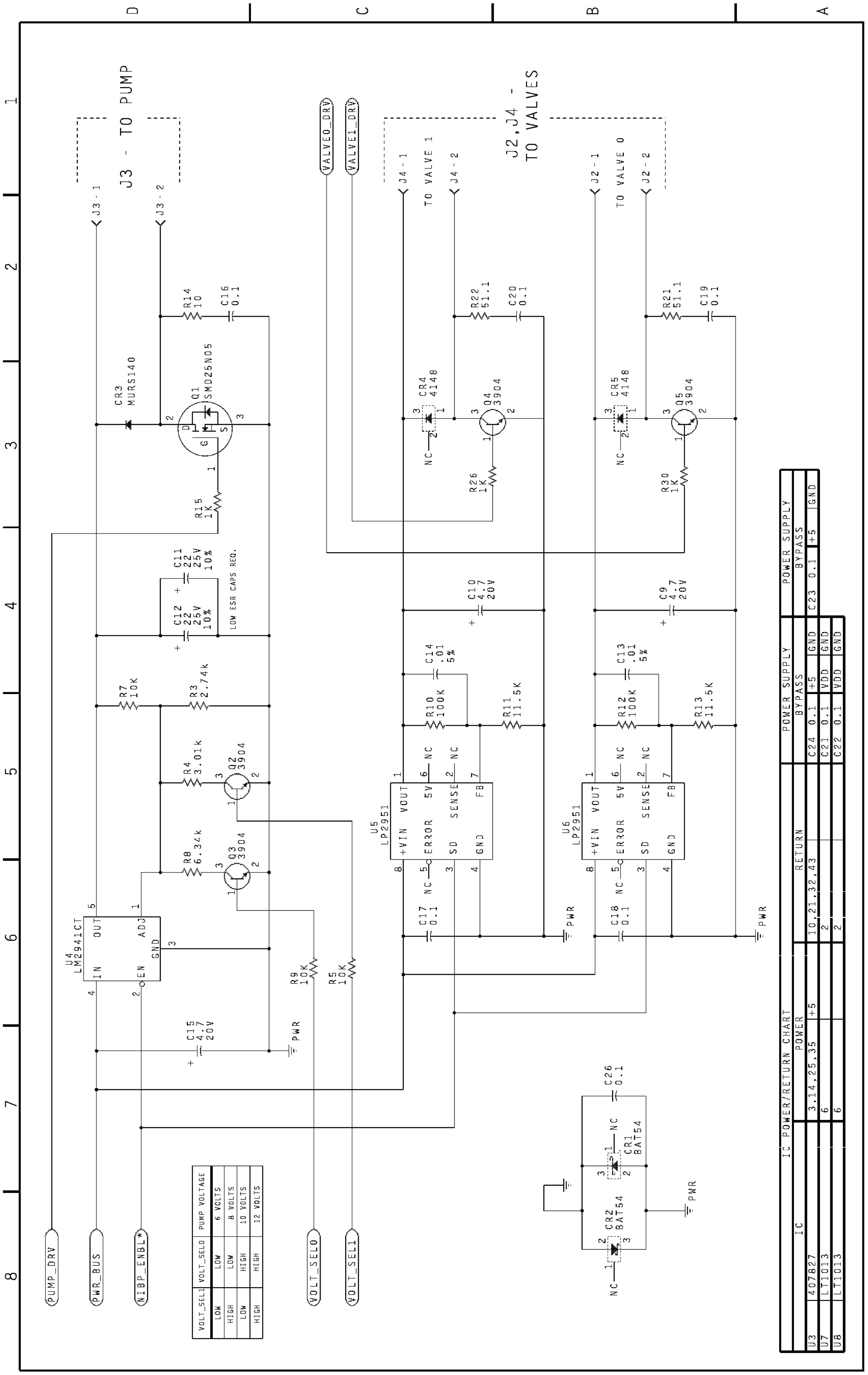
# Schematic Diagram PN SD800316-001C

1 of 2



D
C
B
A
1
2
3
4
5
6
7
8
VALVE1_DRV
VALVE0_DRV
PUMP_DRV
VOLT_SEL1
VOLT_SEL0
DS1 _US250-D0
GRN
RED
R6 340
+5
U3 NBP INTERFACE ASIC PLCC 44
LED_RED
LED_GRN
OVER_PRESSURE
OE
VPP
MODE
NBP_ID1
NBP_ID0
NOT USED
OSC_OUT
OSC_IN
I/O_7
I/O_6
I/O_5
I/O_4
I/O_3
I/O_2
I/O_1
I/O_0
RD
WR
CS
A1
A0
RESET_OUT
RESET_IN
TESTMODE
FLOAT
R1 2K
R2 1M 5%
Y1 4.194304MHz
C8 22pF 5%
C6 22pF 5%
C7 0.22 +80% -20%
R25 499K
U8 LT1013
OVERPRESSURE TRIP @ 328 mmHG +-5%
R19 10K
VDD
R18 5.36K
R20 1M 5%
R16 10K
R17 10K
R23 10K
R24 10K
R27 49.9K
R28 1K
R29 49.9K
U7 LT1013
C4 0.001 5%
C5 470pF 5%
C3 470pF 5%
R34 100
R35 100
R38 1M
R37 100K
C28 1 16V 10%
R39 100K
CR6 4148
NC
U1 10K
Q6 3904
R32 10K
R33 13K
R31 10K
PWR_BUS
NIBP_ENBL*
C27 0.1
C2 10 10V
C25 0.1
C1 10 10V
R36 10
J2 SPX4053GP
GND
+OUT
+VREF
-OUT
PRESSURE SENSOR
J1 - 24
J1 - 23
J1 - 6 SPARE
J1 - 12 SPARE
J1 - 8 NC
J1 - 10 NC
J1 - 5 NIBP_P7
J1 - 7 NIBP_P6
J1 - 9 NIBP_P5
J1 - 11 NIBP_P4
J1 - 13 NIBP_P3
J1 - 15 NIBP_P2
J1 - 17 NIBP_P1
J1 - 19 NIBP_P0
J1 - 18 NIBP_RD*
J1 - 20 NIBP_WR*
J1 - 16 NIBP_IO*
J1 - 22 NIBP_SEL1
J1 - 21 NIBP_SEL0
J1 - 1
J1 - 3
J1 - 14 NIBP_ENBL*
J1 - 2
J1 - 4
PWR
J1 - TO FAN BOARD

**2 of 2**


D
C
B
A
1
2
3
4
5
6
7
8
J3 - TO PUMP
J3-1
J3-2
J2,J4 - TO VALVES
J4-1
TO VALVE 1
J4-2
J2-1
TO VALVE 0
J2-2
VALVE0_DRV
VALVE1_DRV
R14 10
C16 0.1
CR3 MURS140
Q1 SMD25N05
R15 1K
C11 22 25V 10%
C12 22 25V 10%
LOW ESR CAPS REQ.
R7 10K
R3 2.74k
R4 3.01k
Q2 3904
R8 6.34k
Q3 3904
U4 LM2941CT
IN
OUT
ADJ
GND
EN
C15 4.7 20V
PWR
R9 10K
R5 10K
R22 51.1
C20 0.1
CR4 4148
Q4 3904
R26 1K
NC
R21 51.1
C19 0.1
CR5 4148
Q5 3904
R30 1K
C10 4.7 20V
C9 4.7 20V
C14 .01 5%
C13 .01 5%
R10 100K
R11 11.5K
R12 100K
R13 11.5K
U5 LP2951
U6 LP2951
+VIN
VOUT
ERROR
5V
SD
SENSE
GND
FB
C17 0.1
C18 0.1
C26 0.1
CR1 BAT54
CR2 BAT54
PUMP_DRV
PWR_BUS
NIBP_ENBL*
VOLT_SEL0
VOLT_SEL1

| VOLT_SEL1 | VOLT_SEL0 | PUMP VOLTAGE |
|---|---|---|
| LOW | LOW | 6 VOLTS |
| HIGH | LOW | 8 VOLTS |
| LOW | HIGH | 10 VOLTS |
| HIGH | HIGH | 12 VOLTS |

IC POWER/RETURN CHART

| IC | | POWER | | RETURN | POWER SUPPLY BYPASS | | | | POWER SUPPLY BYPASS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U3 | 407827 | 3,14,25,35 | +5 | 10,21,32,43 | C24 | 0.1 | +5 | GND | C23 | 0.1 | +5 | GND |
| U7 | LT1013 | 6 | | 2 | C21 | 0.1 | VDD | GND | | | | |
| U8 | LT1013 | 6 | | 2 | C22 | 0.1 | VDD | GND | | | | |

*For your notes*

# 29 ACQUISITION PROCESSOR PCB PN 801040/800330

**General** ........................................................................................29-2

**Parts Location Diagram PN 801040-001A/002A** ..............................29-3

**Parts List PN 801040-001A/002A** ....................................................29-5

**Schematic Diagram PN SD801040-001A** ...........................................29-7

**Assembly Configurations PN800330**................................................29-19

**Parts Location Diagram PN 800330B** .............................................29-20

**Parts List PN 800330B** ...................................................................29-22

**Schematic Diagram PN SD800330-001B** .........................................29-24

# General

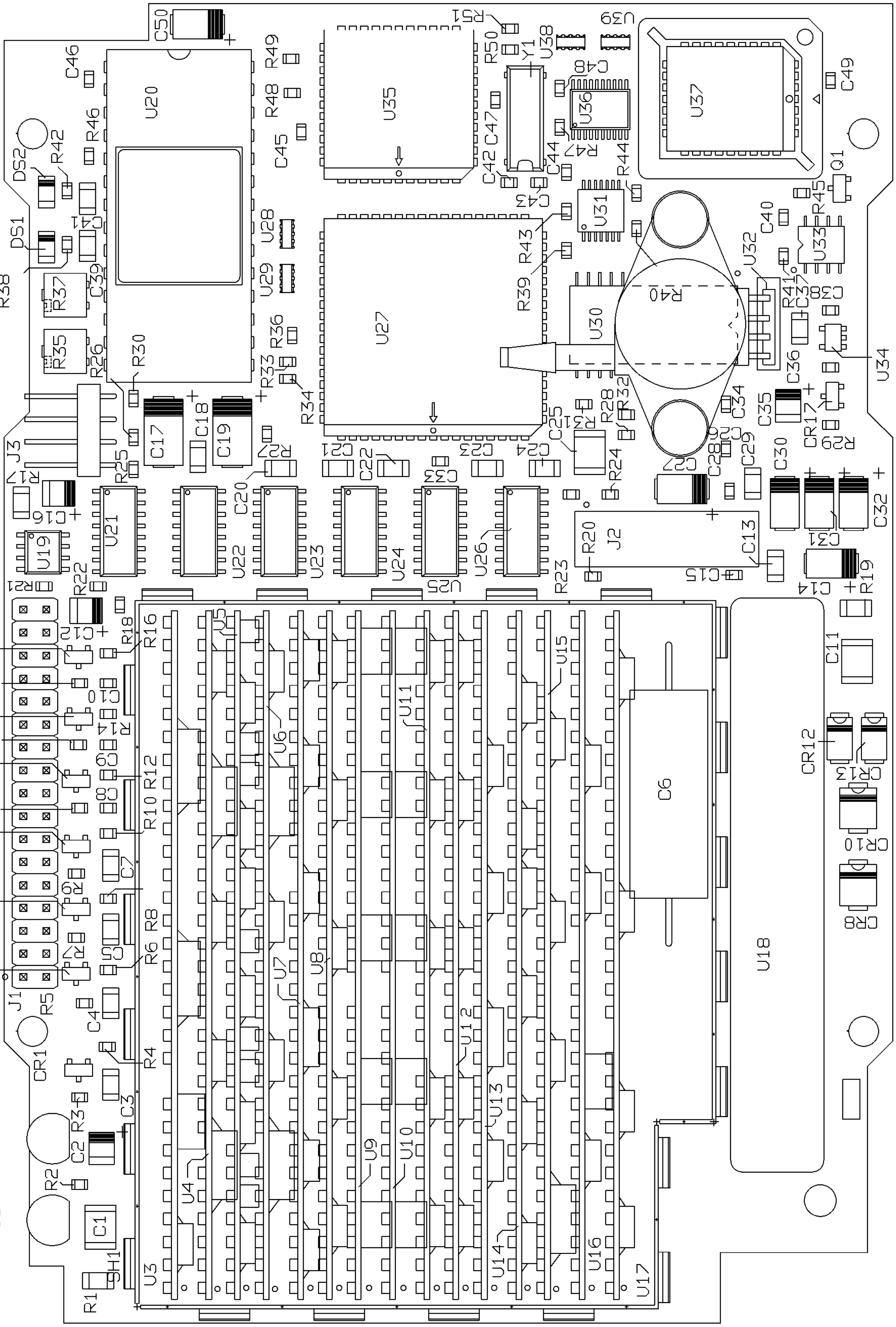
There are many different versions of the acquisition processor PCB:

- pn 800330-0XX, were used first in all Tram modules; and
- pn 801040-001, was introduced in the SL-series modules for all 10-leadwire configurations; and
- pn 801040-002, was introduced in the A-series modules for Tram 800A/850A 5-leadwire configurations.

**NOTE**
You may replace any Tram 800A/850A 5-lead version of the pn 800330 board with a pn 801040-002 board and any 10-lead version of the pn 800330 board with a pn 801040-001 board.

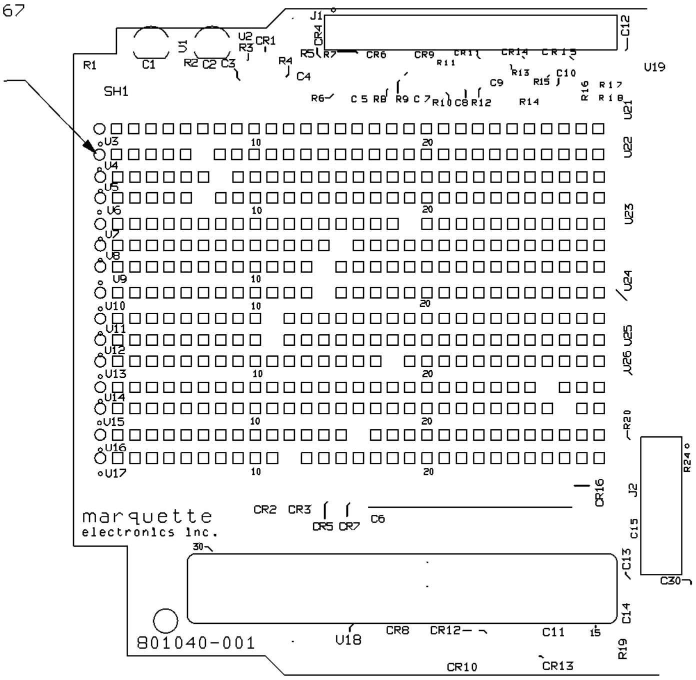
# Parts Location Diagram PN 801040-001A/002A

1 of 2


C50
R51
U39
R49
C46
U20
R48
U35
R50
Y1
U38
C48
U36
U37
C49
C45
R46
R42
C47
C42
C44
R47
R44
DS2
C43
Q1
R45
C41
U28
U31
C40
DS1
R43
U33
U32
R38
C39
U29
R37
R39
R41
C37
C38
R40
R36
U27
U30
R35
R26
R30
R33
C36
U34
R34
C34
C35
R32
R28
R31
C25
C18
C17
C19
R27
J3
C21
C22
C23
C24
R24
C26
C28
C29
C30
CR17
R29
R25
R17
C20
C33
C27
C16
U21
U22
U23
U24
U25
U26
J2
C13
C32
C31
U19
R20
R22
R23
C15
C14
R19
R21
C12
R16
R18
U5
U15
C11
CR15
R15
C10
CR14
U11
R13
R14
U6
C9
CR11
R12
CR12
CR13
C6
R11
C8
R10
CR9
CR10
C7
CR6
R9
R8
CR8
R7
C5
U18
CR4
R6
U7
U8
J1
R5
C4
U12
R4
CR1
U13
C3
R3
U2
C2
U9
U10
R2
U4
U1
C1
U14
U16
SH1
U3
U17
R1

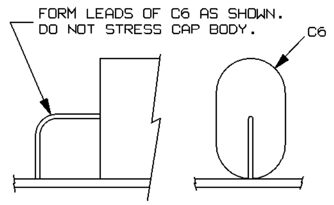
## 2 of 2

INSTALL ITEM 67
AT DESIGNATED
LOCATIONS
(30 PL.)
SEE CHART A


J1
C12
U19
R1
C1
R2 C2 C3
U2
CR1
R3
R4
C4
R5
R7
CR4
CR6
CR9
CR11
CR14
CR15
R11
R13
C10
C9
R15
R16
R17
R18
R6
C5 R8 R9 C7 R10 C8 R12
R14
SH1
U21
U22
U23
U24
U25
U26
R20
R24
J2
CR16
C15
C13
C30
C14
R19
U3
U4
U5
U6
U7
U8
U9
U10
U11
U12
U13
U14
U15
U16
U17
10
20
marquette
electronics inc.
CR2 CR3
CR5 CR7
C6
30
801040-001
U18
CR8
CR12
C11
15
CR10
CR13

| CHART A | |
|---|---|
| U3 | 5,30 |
| U4 | 1,28 |
| U5 | 1,27 |
| U6 | 1,28 |
| U7 | 11,30 |
| U8 | 2,30 |
| U9 | 1,29 |
| U10 | 1,29 |
| U11 | 1,29 |
| U12 | 1,29 |
| U13 | 7,30 |
| U14 | 15,26 |
| U15 | 12,26 |
| U16 | 14,29 |
| U17 | 3,27 |

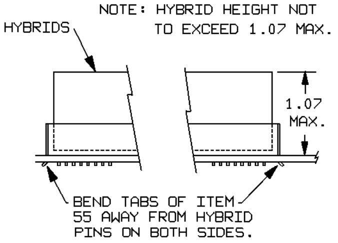
SOCKET PIN LOCATIONS



FORM LEADS OF C6 AS SHOWN.
DO NOT STRESS CAP BODY.

MOUNT C6 IN THE ORIENTATION SHOWN.

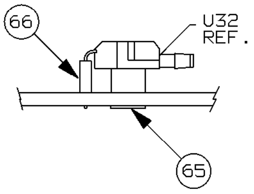
DETAIL A


HYBRIDS
1.07
MAX.

NOTE: HYBRID HEIGHT NOT
TO EXCEED 1.07 MAX.

BEND TABS OF ITEM
55 AWAY FROM HYBRID
PINS ON BOTH SIDES.

DETAIL B


66
U32
REF.
65

2 REQ'D

DETAIL C

# Parts List PN 801040-001A/002A

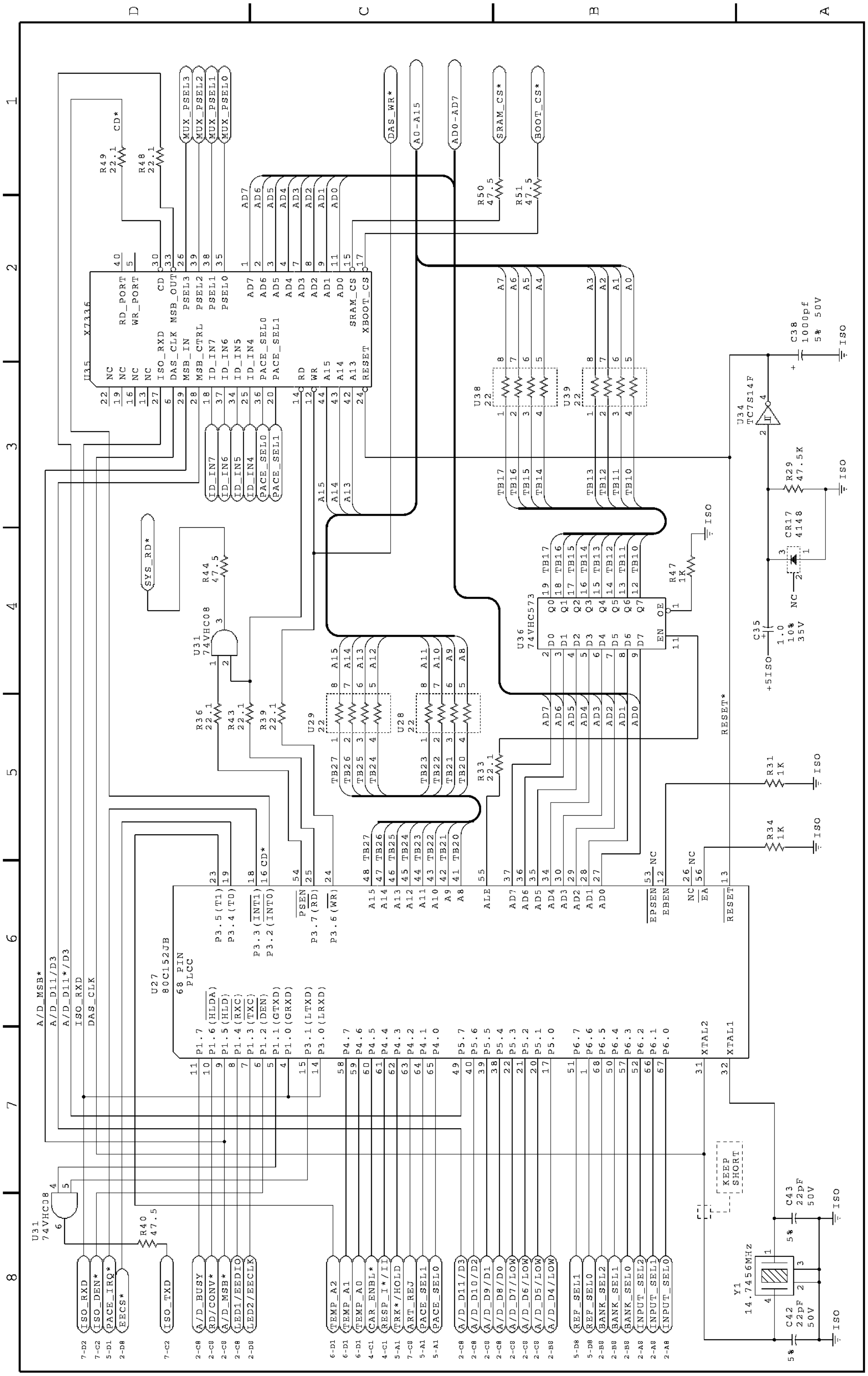
| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| C1, 11, 25 | Cap, Cer, 0.47µF, 20% | 1187-474 | 3 |
| C2, 35 | Cap, Tant, 1.0µF, 10%, 35V, SM | 403907-001 | 2 |
| C3-5, 7, 13, 18, 2024, 29, 37, 39, 41 | Cap, Cer, 0.1µF, 20%, 50V | 404370-001 | 15 |
| C6 | Cap, MPE, 10µF, 5%, 35V | 1215-106 | 1 |
| C8-10, 15, 26, 28, 33, 34, 36, 40, 44, 45-49 | Cap, Cer, 0.1µF, 5%, 16V | 411575-002 | 16 |
| C12, 16 | Cap, Tant, 3.3µF, 10%, 20V, SM | 416798-001 | 2 |
| C14, 27, 30, 50 | Cap, Tant, 10µF, 20%, 16V, SM | 1176-106 | 4 |
| C17, 19 | Cap, Tant, 10µF, 20%, 25V, SM | 1152-106 | 1 |
| C31, 32 | Cap, Tant, 4.7µF, 20%, 20V, SM | 402004-001 | 2 |
| C38 | Cap, Cer, 1000pF, 5%, 50V, SM | 411575-003 | 1 |
| C42, 43 | Cap, NPO, 22pF, 5%, 50V, SM | 411576-002 | 2 |
| CR1, 4, 6, 9, 11, 14, 15 | Diode Pair, Series, SM D7000 | 2013-201 | 7 |
| CR8, 10 | Transorb, 15V, 5%, 600W SM6T15A | 403188-001 | 2 |
| CR12, 13 | Diode, Rectifier, 1A, 100V, SM MURS110T3 | 403190-001 | 2 |
| CR17 | Diode, SM MMAD4148 | 401980-001 | 1 |
| DS1, 2 | Light-Emitting Diode, Red, SM 1206 | 414417-002 | 2 |
| J1 | Connector, PC Header, 34-Pin, Vertical | 1778-234 | 1 |
| J2 | Connector, Vertical, 16-Pin | 1847-016 | 1 |
| J3 | PC Post, Right Angle | 1778-436 | 4 |
| Q1 | Transistor, PNP, SM T3906 | 2511-101 | 1 |
| R1 | Res, Cer, 243K, 1%, 1/8W, SM | 1082-798 | 1 |
| R17 | Res, Cer, 2K, 1%, 1/8W, SM | 1082-201 | 1 |
| R19 | Res, Cer, 499K, 1%, 1/8W, SM | 1082-499 | 1 |
| R2, 21 | Res, Cer, 100Ω, 1%, 1/16W, SM | 410334-003 | 2 |
| R3, 5, 7, 9, 11, 13, 15, 18, 22, 27, 31, 34, 38, 41, 42, 47 | Res, Cer, 1K, 1%, 1/16W, SM | 410334-008 | 16 |
| R4, 6, 8, 10, 12, 14, 16, 25, 28, 32, 45, 46 | Res, Cer, 11.5K, 1%, 1/16W, SM | 410334-014 | 12 |
| R20, 23, 24, 26 | Res, Cer, 150Ω, 1%, 1/16W, SM | 410334-028 | 4 |
| R29, 30 | Res, Cer, 45.7K, 1%, 1/16W, SM | 410334-036 | 2 |
| R33, 36, 39, 43, 48, 49 | Res, Cer, 22.1 Ω, 1%, 1/16W, SM | 410334-033 | 6 |
| R35, 37 | Res, Var, 100Ω, 11-Turn | 416248-001 | 2 |
| R40, 44, 50, 51 | Res, Cer, 47.5Ω, 1%, 1/16W, SM | 410334-026 | 4 |
| SH1 | Shield, Fence | 416402-001 | 1 |
| U1 | Sensor, Temperature, TO92 LM35CZ | 403396-001 | 1 |
| U2 | Volt Rgltr, +5V, 0.5%, 100mA, TO92 LP2950 | 402581-001 | 1 |
| U3 | Hybrid, NBP | 404303-001 | 1 |
| U4, 5 | Hybrid, Dual Invasive BP Amplifier | 400867-001 | 2 |

| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| U5 | Hybrid, Quad Invasive BP Driver (For -001 Only) | 401607-001 | 1 |
| U7 | Hybrid, TEMP, Channel 2 | 402100-004 | 1 |
| U8 | Hybrid, TEMP, Channel 1 | 401788-004 | 1 |
| U9, 10 | Hybrid, ECG Final Amplifier | 401787-001 | 2 |
| U11, 12 | Hybrid, ECG Pacemaker Rejection (For -001 Only) | 401786-001 | 2 |
| U12 | Hybrid, ECG Pacemaker Rejection (For -002 Only) | 401786-001 | 1 |
| U13 | Hybrid, Pace Detect | 800982-001 | 1 |
| U14 | Hybrid, ECG Preamplifier II (For -001 Only) | 401790-001 | 1 |
| U15 | Hybrid, ECG Preamplifier | 400869-004 | 1 |
| U16 | Hybrid, RESP Carrier | 400870-001 | 1 |
| U17 | Hybrid, RESP Demodulator (For -001 Only) | 400871-004 | 1 |
| U18 | ECG Defib Protection, 10-Lead (For -001 Only) | 414639-002 | 1 |
| U18 | ECG Defib Protection, 5-Lead (For -002 Only) | 414639-001 | 1 |
| U19 | Operational Ampl, JFET, SM LT1055 | 402396-001 | 1 |
| U20 | ADC, 12-Bit, Custom | 405548-001 | 1 |
| U21-26 | Analog Multiplexer, 4-Channel, Dual, SM DG408DY/ 508DY | 402024-001 | 6 |
| U27 | PAL, Programmed, Communication Control, PLCC 80C152JB | 400368-001 | 1 |
| U28, 29, 38, 39 | Res Ntwk, 22 Ω, SM | 415601-001 | 4 |
| U30 | RAM, Static, 32K x 8-Bit , SM 62256FLP | 3202-256 | 1 |
| U31 | AND Gate, 2-Input, Quad, SM VHC08 | 3057-008 | 1 |
| U32 | Sensor, Pressure, 7.3 PSI | 40446-003 | 1 |
| U33 | EEPROM, Serial, 64 x 16-Bit, SM 93C46 | 406286-001 | 1 |
| U34 | Inverter, Schmitt Trigger, CMOS, SM TC7S14 | 416170-001 | 1 |
| U35 | EPLD, Programmed, Acquisition Processor, PLCC | 416957-001 | 1 |
| U36 | Latch, Type D, Octal VHC573 | 3057-573 | 1 |
| U37 | EPROM, Programmed, Acquisition Processor Boot Code, PLCC | 404905-001 | 1 |
| Y1 | Crystal, 14.7456-MHz, SM | 414847-002 | 1 |
| – | Socket, PLCC, 32-Pin, SM (for ) | 403802-001 | 1 |
| – | Spacer, Round, 6-32 x 1/4 (For U32) | 4663-604 | 2 |
| – | Socket, 4-Pin | 413139-001 | 1 |
| – | Socket, Mini (For U3-17) | 1818-201 | 30 |
| – | Shield, Cover | 416402-002 | 1 |
| – | Circuit Board | 801041-001A | 1 |
| – | Schematic Diagram | SD801040-001A | – |

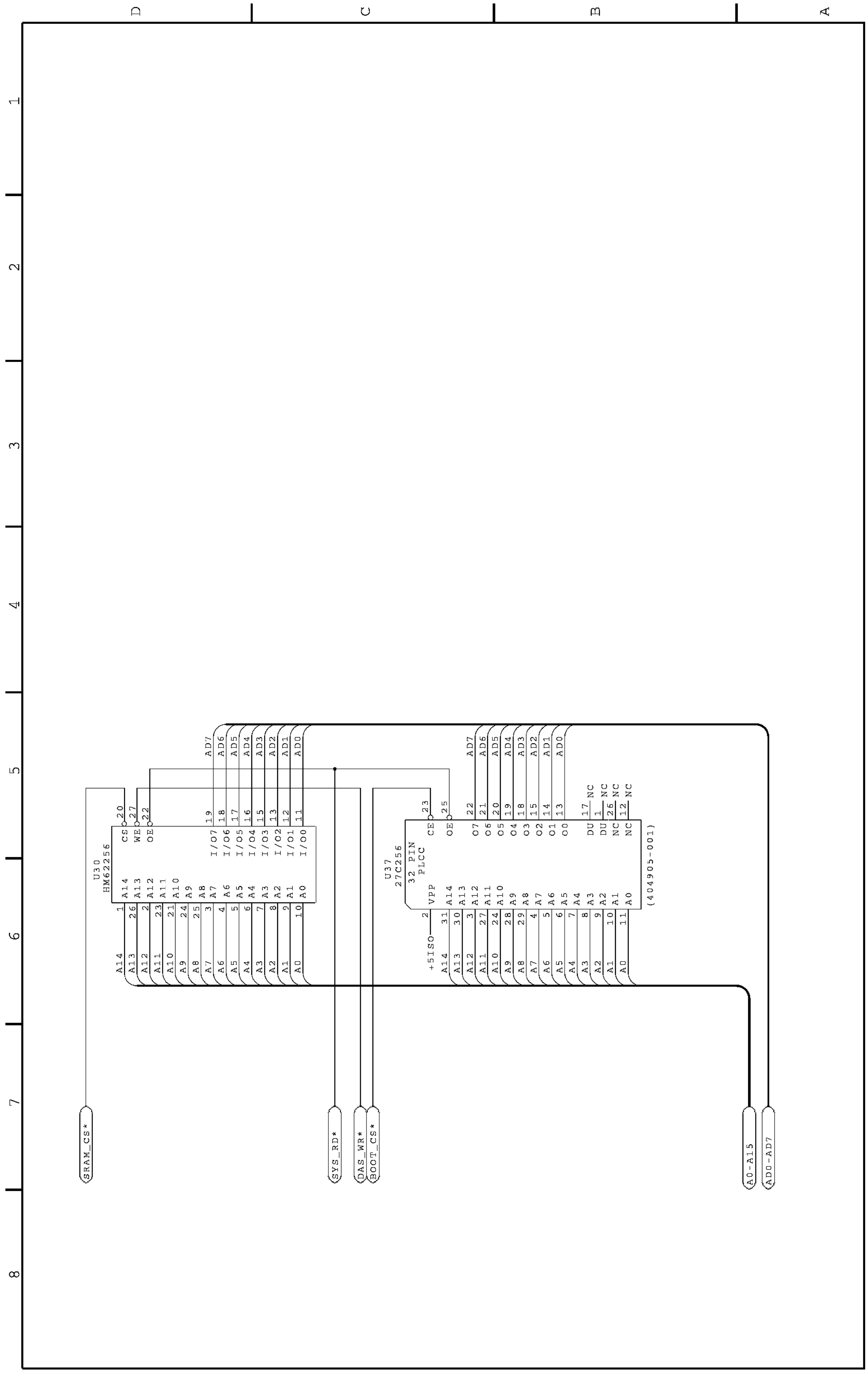
# Schematic Diagram

# PN SD801040-001A

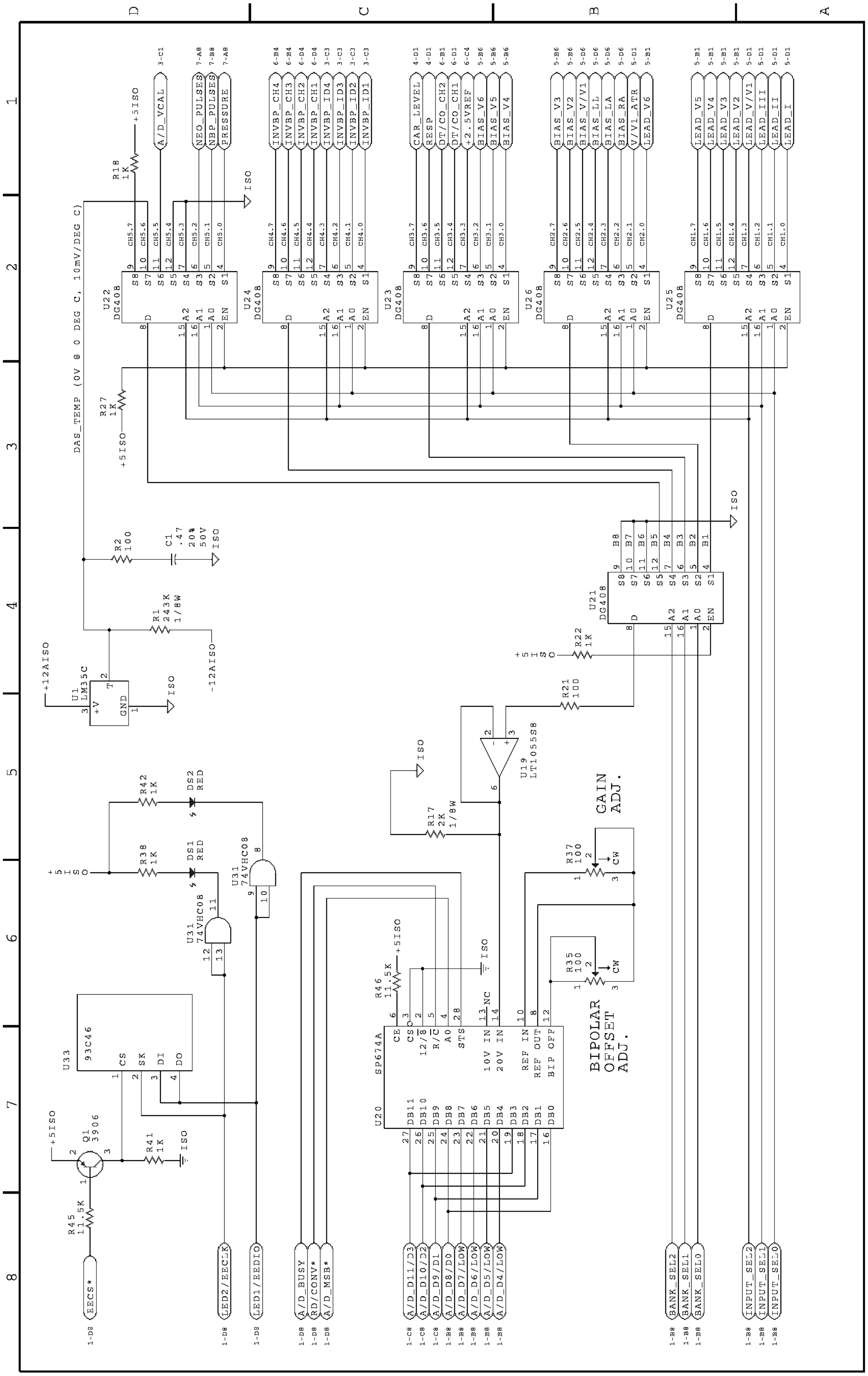
1 of 11


U35 X7336
U27 80C152JB 68 PIN PLCC
U36 74VHC573
U31 74VHC08
U31 74VHC38
U34 TC7S14F
U28 22
U29 22
U38 22
U39 22
Y1 14.7456MHz
R49 22.1
R48 22.1
R50 47.5
R51 47.5
R44 47.5
R36 22.1
R43 22.1
R39 22.1
R33 22.1
R40 47.5
R47 1K
R31 1K
R34 1K
R29 47.5K
CR17 4148
C38 1000pf 5% 50V
C35 1.0 10% 35V
C43 22pF 5% 50V
C42 22pF 5% 50V
KEEP SHORT
MUX_PSEL3
MUX_PSEL2
MUX_PSEL1
MUX_PSEL0
DAS_WR*
A0-A15
AD0-AD7
SRAM_CS*
BOOT_CS*
SYS_RD*
CD*
ID_IN7
ID_IN6
ID_IN5
ID_IN4
PACE_SEL0
PACE_SEL1
RESET*
ISO
+5ISO
A/D_MSB*
A/D_D11/D3
A/D_D11*/D3
ISO_RXD
DAS_CLK
ISO_RXD
ISO_DEN*
PACE_IRQ*
EECS*
ISO_TXD
A/D_BUSY
RD/CONV*
A/D_MSB*
LED1/EEDIO
LED2/EECLK
TEMP_A2
TEMP_A1
TEMP_A0
CAR_ENBL*
RESP_I*/II
TRK*/HOLD
ART_REJ
PACE_SEL1
PACE_SEL0
A/D_D11/D3
A/D_D10/D2
A/D_D9/D1
A/D_D8/D0
A/D_D7/LOW
A/D_D6/LOW
A/D_D5/LOW
A/D_D4/LOW
REF_SEL1
REF_SEL0
BANK_SEL2
BANK_SEL1
BANK_SEL0
INPUT_SEL2
INPUT_SEL1
INPUT_SEL0
D
C
B
A
1
2
3
4
5
6
7
8

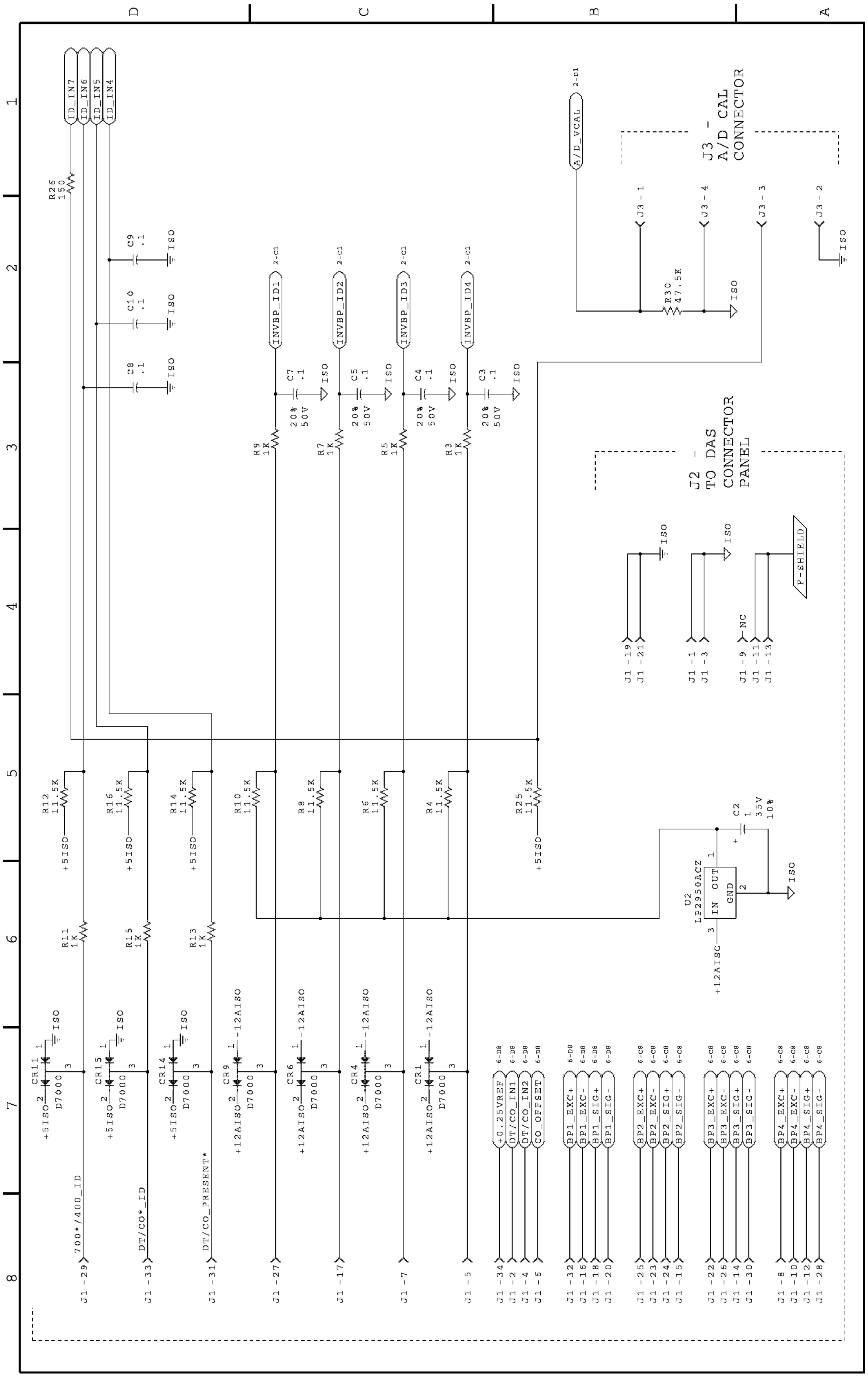
**2 of 12**


U30
HM62256
CS
WE
OE
A14
A13
A12
A11
A10
A9
A8
A7
A6
A5
A4
A3
A2
A1
A0
I/O7
I/O6
I/O5
I/O4
I/O3
I/O2
I/O1
I/O0
U37
27C256
32 PIN
PLCC
VPP
CE
OE
O7
O6
O5
O4
O3
O2
O1
O0
DU
NC
+5ISO
(404905-001)
AD0
AD1
AD2
AD3
AD4
AD5
AD6
AD7
SRAM_CS*
SYS_RD*
DAS_WR*
BOOT_CS*
A0-A15
AD0-AD7
A
B
C
D
1
2
3
4
5
6
7
8

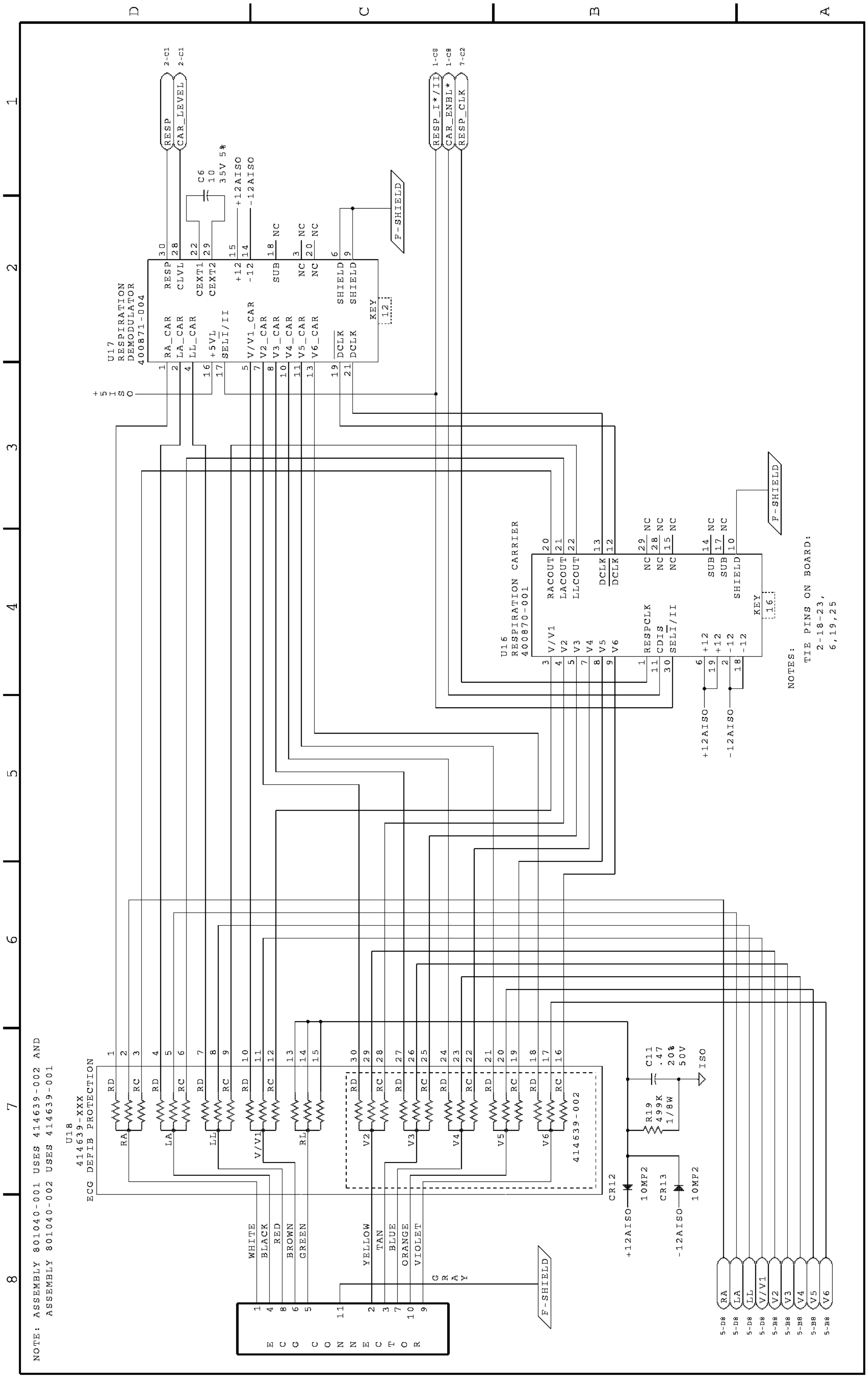
**3 of 12**


D
C
B
A
1
2
3
4
5
6
7
8
U22 DG408
U24 DG408
U23 DG408
U26 DG408
U25 DG408
U21 DG408
U1 LM35C
U19 LT1055S8
U20 SP674A
U31 74VHC08
U33 93C46
Q1 3906
DAS_TEMP (0V @ 0 DEG C, 10mV/DEG C)
A/D_VCAL
NEO_PULSES
NBP_PULSES
PRESSURE
INVBP_CH4
INVBP_CH3
INVBP_CH2
INVBP_CH1
INVBP_ID4
INVBP_ID3
INVBP_ID2
INVBP_ID1
CAR_LEVEL
RESP
DT/CO_CH2
DT/CO_CH1
+2.5VREF
BIAS_V6
BIAS_V5
BIAS_V4
BIAS_V3
BIAS_V2
BIAS_V/V1
BIAS_LL
BIAS_LA
BIAS_RA
V/V1_ATR
LEAD_V6
LEAD_V5
LEAD_V4
LEAD_V3
LEAD_V2
LEAD_V/V1
LEAD_III
LEAD_II
LEAD_I
R18 1K
R27 1K
R2 100
C1 .47 20% 50V
R1 243K 1/8W
R22 1K
R21 100
R17 2K 1/8W
R37 100
R35 100
R42 1K
R38 1K
R41 1K
R45 11.5K
R46 11.5K
DS2 RED
DS1 RED
GAIN ADJ.
BIPOLAR OFFSET ADJ.
+5ISO
+12AISO
-12AISO
ISO
CW
EECS*
LED2/EECLK
LED1/EEDIO
A/D_BUSY
RD/CONV*
A/D_MSB*
A/D_D11/D3
A/D_D10/D2
A/D_D9/D1
A/D_D8/D0
A/D_D7/LOW
A/D_D6/LOW
A/D_D5/LOW
A/D_D4/LOW
BANK_SEL2
BANK_SEL1
BANK_SEL0
INPUT_SEL2
INPUT_SEL1
INPUT_SEL0

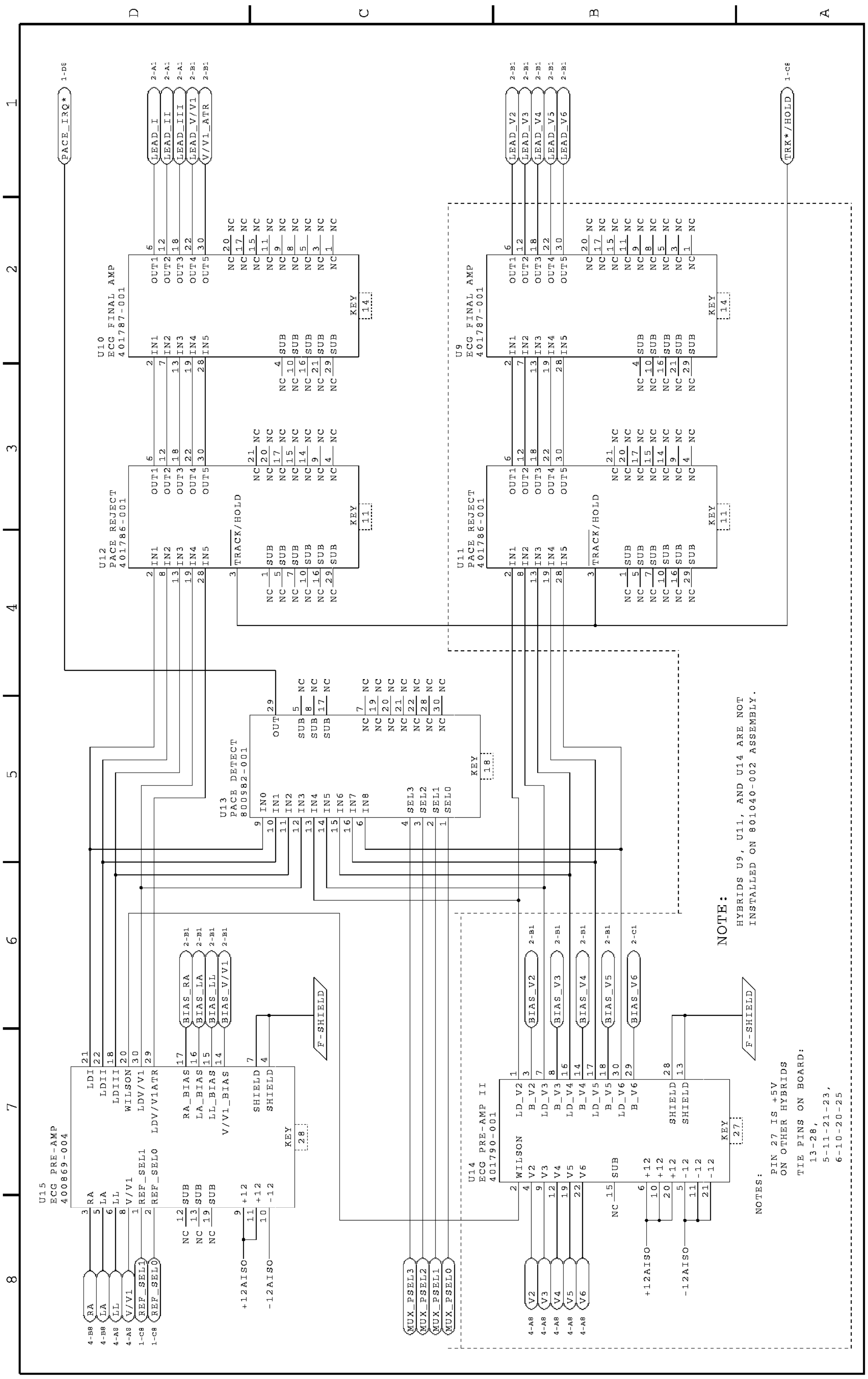
**4 of 12**


D
C
B
A
1
2
3
4
5
6
7
8
ID_IN7
ID_IN6
ID_IN5
ID_IN4
R26 150
C9 .1
C10 .1
C8 .1
ISO
INVBP_ID1
INVBP_ID2
INVBP_ID3
INVBP_ID4
2-C1
C7 .1
C5 .1
C4 .1
C3 .1
20% 50V
R9 1K
R7 1K
R5 1K
R3 1K
A/D_VCAL
2-D1
J3 - A/D CAL CONNECTOR
J3 - 1
J3 - 4
J3 - 3
J3 - 2
R30 47.5K
J2 - TO DAS CONNECTOR PANEL
F-SHIELD
NC
J1 - 19
J1 - 21
J1 - 1
J1 - 3
J1 - 9
J1 - 11
J1 - 13
R12 11.5K
R16 11.5K
R14 11.5K
R10 11.5K
R8 11.5K
R6 11.5K
R4 11.5K
R25 11.5K
+5ISO
C2 1 35V 10%
U2 LP2950ACZ
IN OUT GND
+12AISO
R11 1K
R15 1K
R13 1K
CR11
CR15
CR14
CR9
CR6
CR4
CR1
D7000
-12AISO
+12AISO
700*/400_ID
DT/CO*_ID
DT/CO_PRESENT*
J1 - 29
J1 - 33
J1 - 31
J1 - 27
J1 - 17
J1 - 7
J1 - 5
+0.25VREF
DT/CO_IN1
DT/CO_IN2
CO_OFFSET
6-D8
J1 - 34
J1 - 2
J1 - 4
J1 - 6
BP1_EXC+
BP1_EXC-
BP1_SIG+
BP1_SIG-
J1 - 32
J1 - 16
J1 - 18
J1 - 20
BP2_EXC+
BP2_EXC-
BP2_SIG+
BP2_SIG-
6-C8
J1 - 25
J1 - 23
J1 - 24
J1 - 15
BP3_EXC+
BP3_EXC-
BP3_SIG+
BP3_SIG-
J1 - 22
J1 - 26
J1 - 14
J1 - 30
BP4_EXC+
BP4_EXC-
BP4_SIG+
BP4_SIG-
J1 - 8
J1 - 10
J1 - 12
J1 - 28

5 of 12


U17
RESPIRATION
DEMODULATOR
400871-004
RA_CAR
LA_CAR
LL_CAR
+5VL
SELI/II
V/V1_CAR
V2_CAR
V3_CAR
V4_CAR
V5_CAR
V6_CAR
DCLK
DCLK
RESP
CLVL
CEXT1
CEXT2
+12
-12
SUB
NC
NC
SHIELD
SHIELD
KEY
12
C6
10
35V 5%
+12AISO
-12AISO
RESP
CAR_LEVEL
2-C1
RESP_I*/II
CAR_ENBL*
RESP_CLK
1-C8
7-C2
P-SHIELD
+5ISO
U16
RESPIRATION CARRIER
400870-001
V/V1
V2
V3
V4
V5
V6
RESPCLK
CDIS
SELI/II
RACOUT
LACOUT
LLCOUT
DCLK
DCLK
NC
NC
NC
SUB
SUB
SHIELD
+12
+12
-12
-12
KEY
16
+12AISO
-12AISO
NOTES:
TIE PINS ON BOARD:
2-18-23,
6,19,25
U18
414639-XXX
ECG DEFIB PROTECTION
RD
RC
RA
LA
LL
V/V1
RL
V2
V3
V4
V5
V6
414639-002
C11
.47
20%
50V
ISO
R19
499K
1/8W
CR12
10MF2
CR13
10MF2
+12AISO
-12AISO
WHITE
BLACK
RED
BROWN
GREEN
YELLOW
TAN
BLUE
ORANGE
VIOLET
GRAY
F-SHIELD
ECG CONNECTOR
RA
LA
LL
V/V1
V2
V3
V4
V5
V6
5-D8
5-B8
NOTE: ASSEMBLY 801040-001 USES 414639-002 AND
ASSEMBLY 801040-002 USES 414639-001
D
C
B
A
1
2
3
4
5
6
7
8

**6 of 12**


U10
ECG FINAL AMP
401787-001
U9
ECG FINAL AMP
401787-001
U12
PACE REJECT
401786-001
U11
PACE REJECT
401786-001
U13
PACE DETECT
800982-001
U15
ECG PRE-AMP
400869-004
U14
ECG PRE-AMP II
401790-001
PACE_IRQ*
LEAD_I
LEAD_II
LEAD_III
LEAD_V/V1
V/V1_ATR
LEAD_V2
LEAD_V3
LEAD_V4
LEAD_V5
LEAD_V6
TRK*/HOLD
TRACK/HOLD
BIAS_RA
BIAS_LA
BIAS_LL
BIAS_V/V1
BIAS_V2
BIAS_V3
BIAS_V4
BIAS_V5
BIAS_V6
F-SHIELD
RA
LA
LL
V/V1
REF_SEL1
REF_SEL0
MUX_PSEL3
MUX_PSEL2
MUX_PSEL1
MUX_PSEL0
V2
V3
V4
V5
V6
+12AISO
-12AISO
KEY
NOTE:
HYBRIDS U9, U11, AND U14 ARE NOT
INSTALLED ON 801040-002 ASSEMBLY.
NOTES:
PIN 27 IS +5V
ON OTHER HYBRIDS
TIE PINS ON BOARD:
13-28,
5-11-21-23,
6-10-20-25

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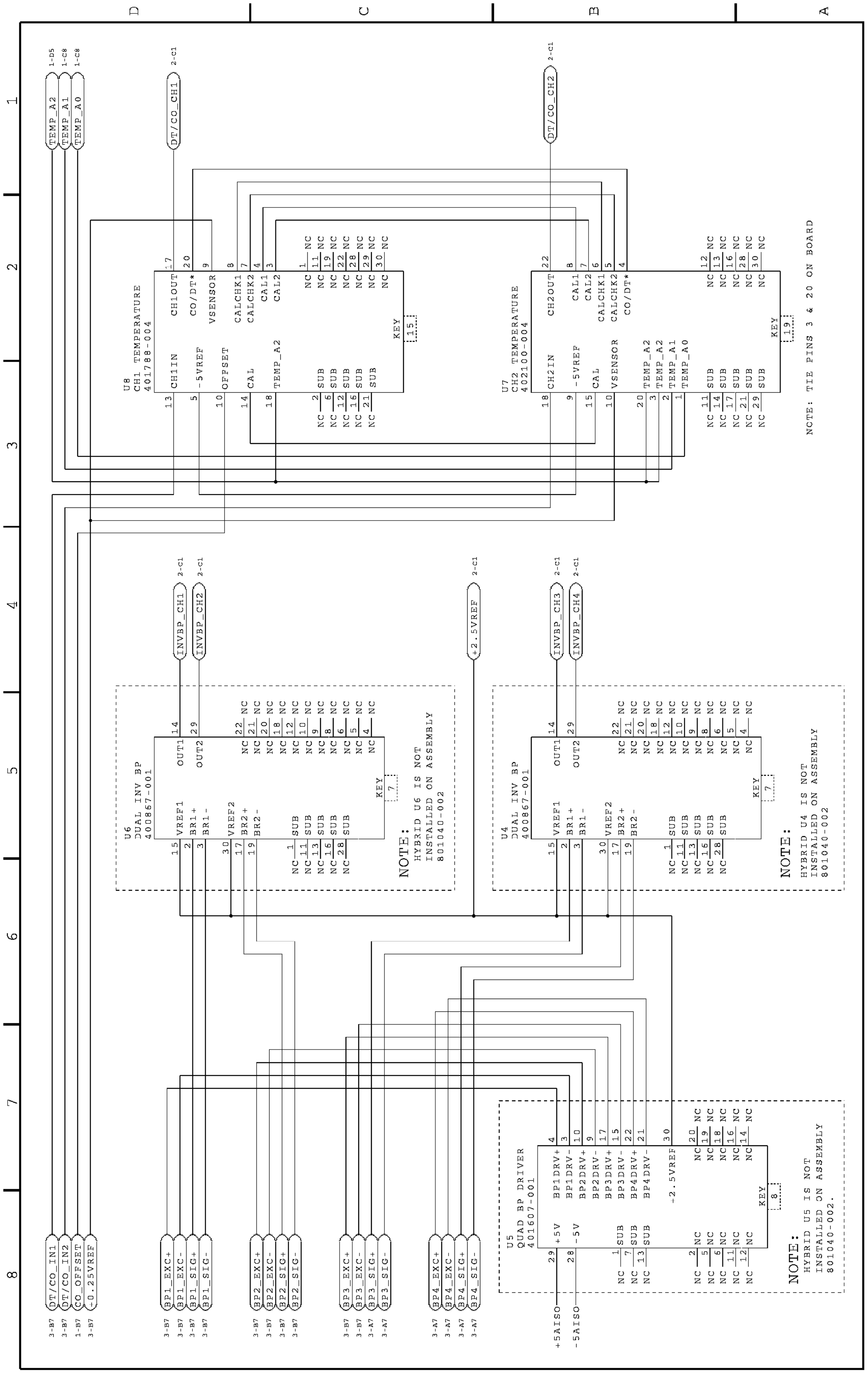
U8
CH1 TEMPERATURE
401788-004
CH1OUT
CO/DT*
VSENSOR
CALCHK1
CALCHK2
CAL1
CAL2
CH1IN
-5VREF
OFFSET
CAL
TEMP_A2
KEY
U7
CH2 TEMPERATURE
402100-004
CH2OUT
CH2IN
VSENSOR
TEMP_A1
TEMP_A0
NOTE: TIE PINS 3 & 20 ON BOARD
TEMP_A2
TEMP_A1
TEMP_A0
DT/CO_CH1
DT/CO_CH2
U6
DUAL INV BP
400867-001
OUT1
OUT2
VREF1
BR1+
BR1-
VREF2
BR2+
BR2-
SUB
NC
NOTE:
HYBRID U6 IS NOT INSTALLED ON ASSEMBLY 801040-002
U4
DUAL INV BP
400867-001
NOTE:
HYBRID U4 IS NOT INSTALLED ON ASSEMBLY 801040-002
INVBP_CH1
INVBP_CH2
INVBP_CH3
INVBP_CH4
+2.5VREF
U5
QUAD BP DRIVER
401607-001
+5V
-5V
BP1DRV+
BP1DRV-
BP2DRV+
BP2DRV-
BP3DRV+
BP3DRV-
BP4DRV+
BP4DRV-
-2.5VREF
NOTE:
HYBRID U5 IS NOT INSTALLED ON ASSEMBLY 801040-002.
+5AISO
-5AISO
DT/CO_IN1
DT/CO_IN2
CO_OFFSET
-0.25VREF
BP1_EXC+
BP1_EXC-
BP1_SIG+
BP1_SIG-
BP2_EXC+
BP2_EXC-
BP2_SIG+
BP2_SIG-
BP3_EXC+
BP3_EXC-
BP3_SIG+
BP3_SIG-
BP4_EXC+
BP4_EXC-
BP4_SIG+
BP4_SIG-
A
B
C
D
1
2
3
4
5
6
7
8

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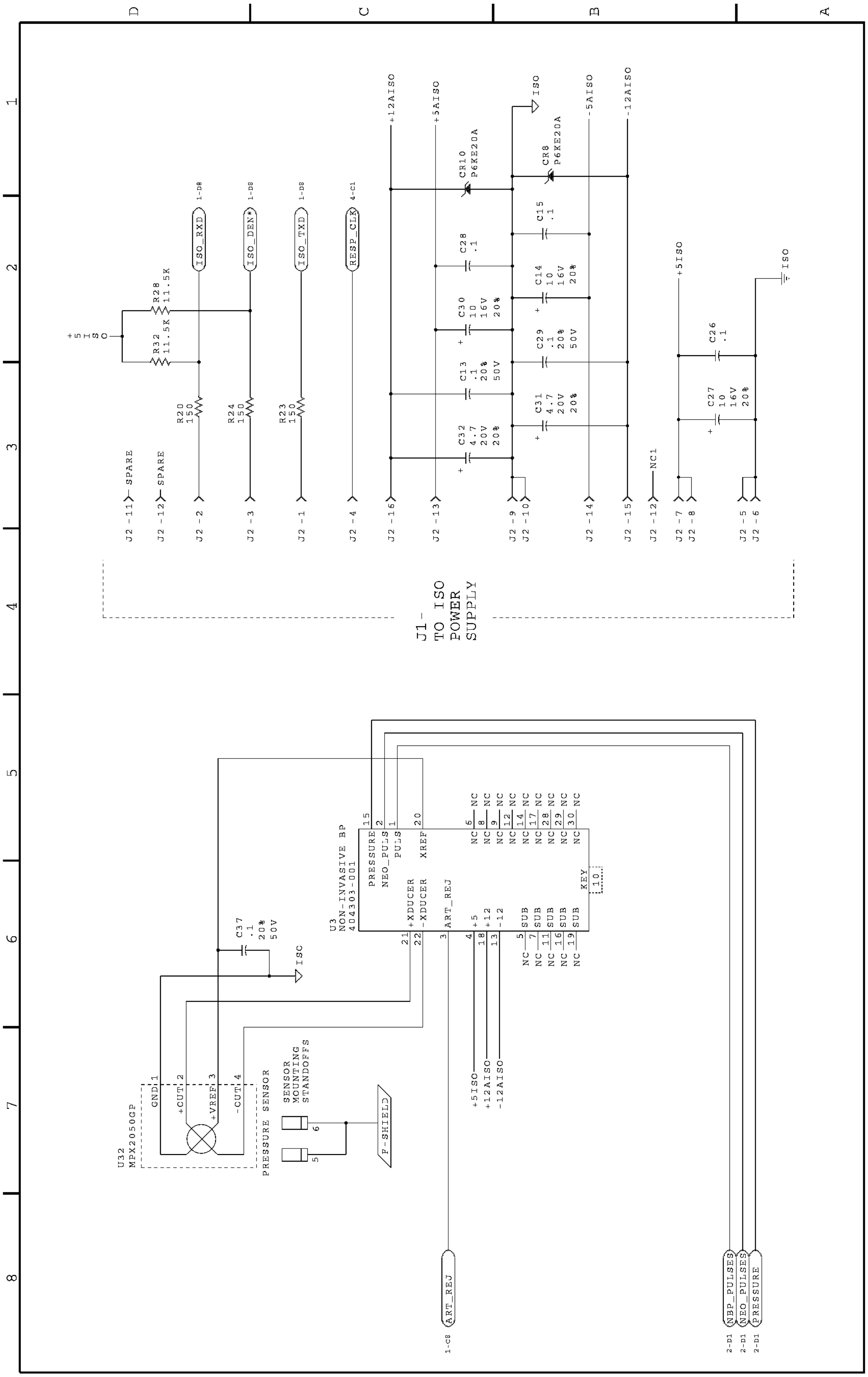
D
C
B
A
1
2
3
4
5
6
7
8
J1-
TO ISO
POWER
SUPPLY
J2 -11 SPARE
J2 -12 SPARE
J2 -2
J2 -3
J2 -1
J2 -4
J2 -16
J2 -13
J2 -9
J2 -10
J2 -14
J2 -15
J2 -12 NC1
J2 -7
J2 -8
J2 -5
J2 -6
ISO_RXD 1-D8
ISO_DEN* 1-D8
ISO_TXD 1-D8
RESP_CLK 4-C1
+5ISO
R28 11.5K
R32 11.5K
R20 150
R24 150
R23 150
+12AISO
+5AISO
ISO
-5AISO
-12AISO
CR10 P6KE20A
CR8 P6KE20A
C15 .1
C28 .1
C30 10 16V 20%
C14 10 16V 20%
C29 .1 20% 50V
C13 .1 20% 50V
C31 4.7 20V 20%
C32 4.7 20V 20%
+5ISO
ISO
C26 .1
C27 10 16V 20%
U3
NON-INVASIVE BP
404303-001
PRESSURE 15
NEO_PULS 2
PULS 1
XREF 20
+XDUCER 21
-XDUCER 22
ART_REJ 3
+5 4
+12 18
-12 13
SUB 5
SUB 7
SUB 11
SUB 16
SUB 19
NC 6
NC 8
NC 9
NC 12
NC 14
NC 17
NC 28
NC 29
NC 30
KEY 10
C37 .1 20% 50V
ISC
U32
MPX2050GP
PRESSURE SENSOR
GND 1
+OUT 2
+VREF 3
-OUT 4
SENSOR MOUNTING STANDOFFS
5
6
F-SHIELD
+5ISO
+12AISO
-12AISO
ART_REJ 1-C8
NBP_PULSES 2-D1
NEO_PULSES 2-D1
PRESSURE 2-D1

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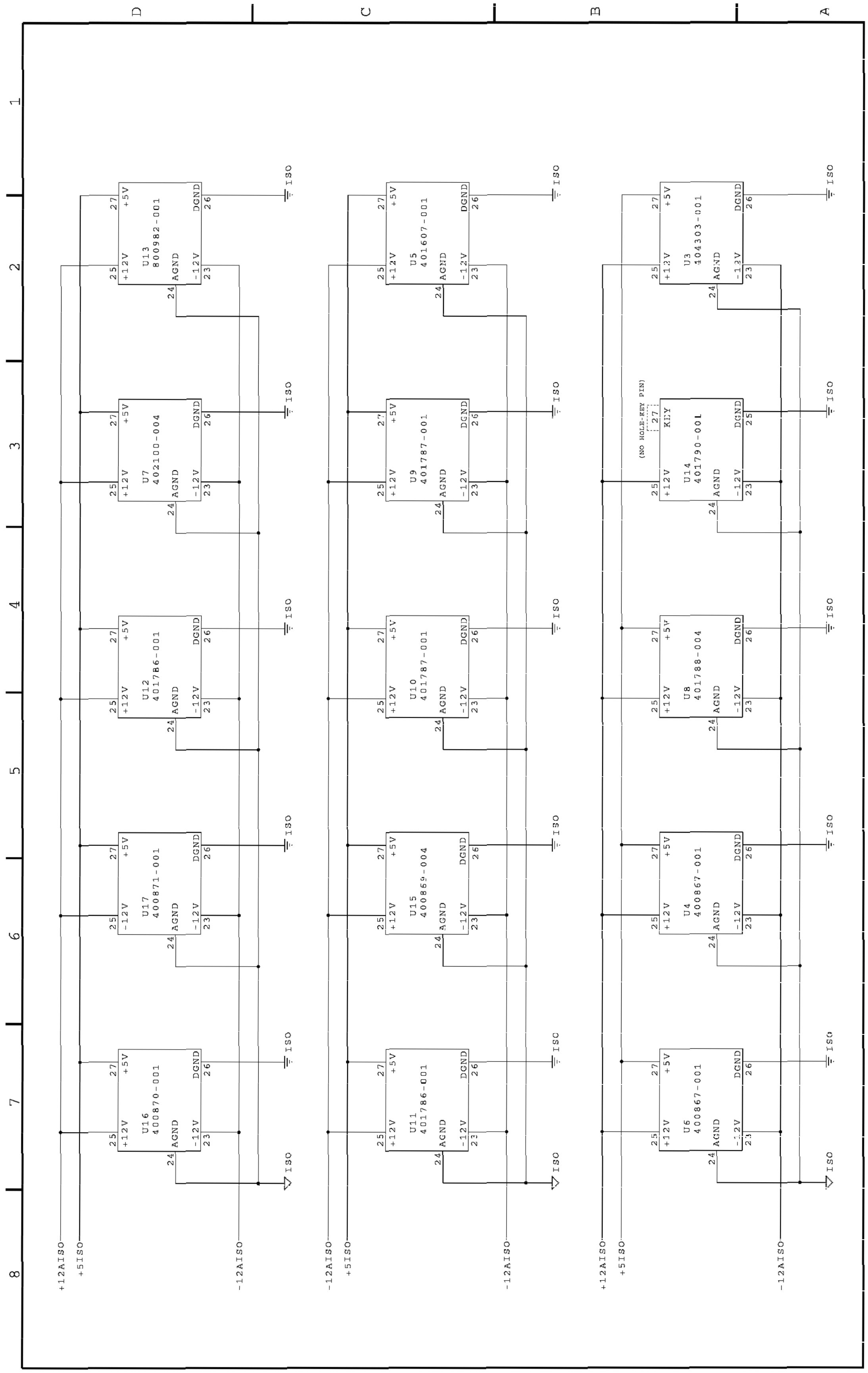
D
C
B
A
1
2
3
4
5
6
7
8
U13
800982-001
U7
402100-004
U12
401786-001
U17
400871-001
U16
400870-001
U5
401607-001
U9
401787-001
U10
401787-001
U15
400869-004
U11
401786-001
U3
404303-001
U14
401790-001
U8
401788-004
U4
400867-001
U6
400867-001
+12V
-12V
+5V
AGND
DGND
KEY
(NO HOLE-KEY PIN)
23
24
25
26
27
ISO
+12AISO
+5ISO
-12AISO

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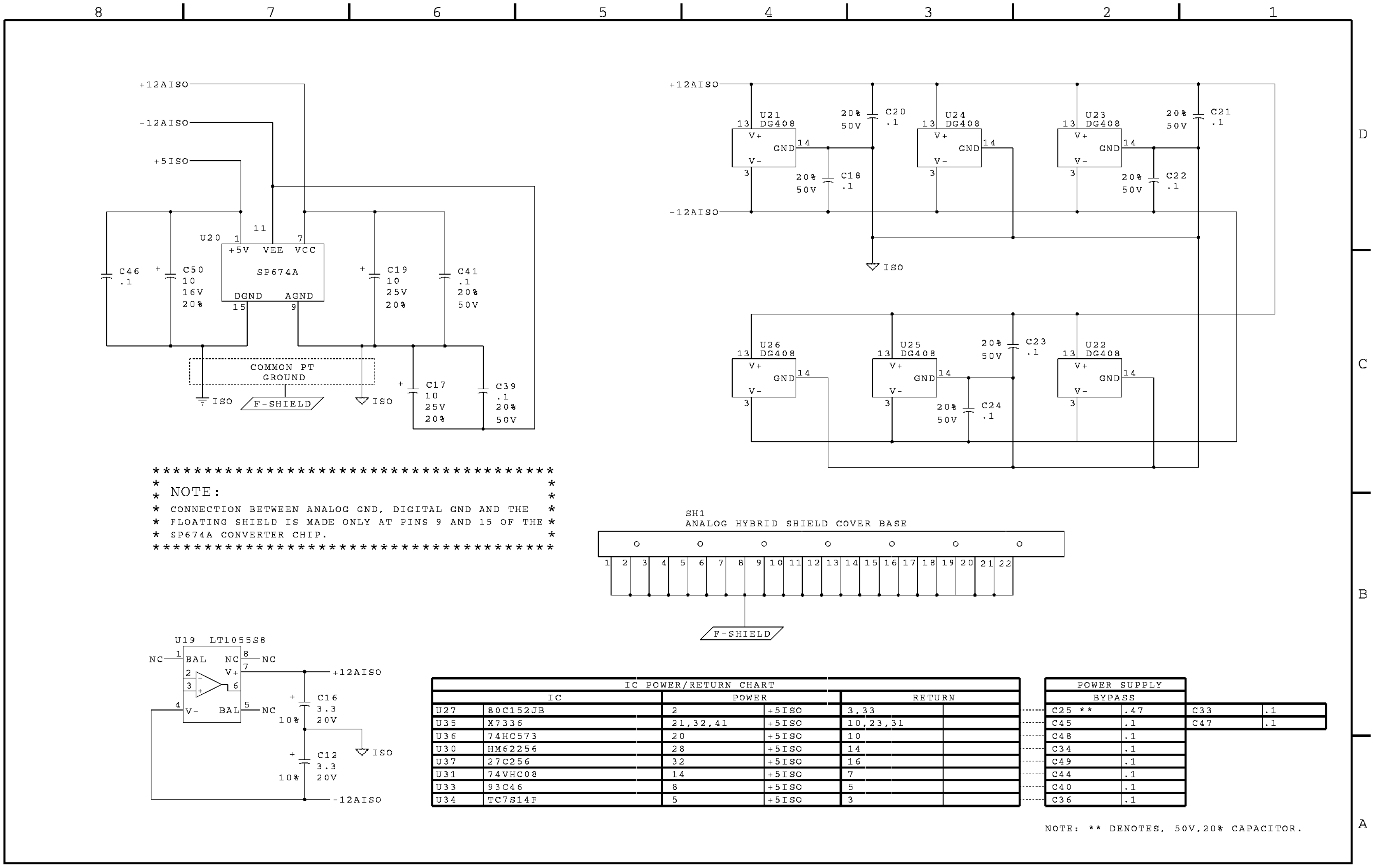

1
2
3
4
5
6
7
8
A
B
C
D
+12AISO
-12AISO
+5ISO
U20
SP674A
+5V
VEE
VCC
DGND
AGND
1
11
7
15
9
C46
.1
C50
10
16V
20%
C19
10
25V
20%
C41
.1
20%
50V
C17
10
25V
20%
C39
.1
20%
50V
COMMON PT
GROUND
ISO
F-SHIELD
U21
DG408
U24
DG408
U23
DG408
U26
DG408
U25
DG408
U22
DG408
V+
V-
GND
13
14
3
C20
.1
C21
.1
C18
.1
C22
.1
C23
.1
C24
.1
20%
50V
ISO
SH1
ANALOG HYBRID SHIELD COVER BASE
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
F-SHIELD
U19 LT1055S8
NC
BAL
NC
V+
V-
BAL
1
2
3
4
5
6
7
8
+12AISO
-12AISO
C16
3.3
20V
10%
C12
3.3
20V
10%
ISO

```
*****************************************
* NOTE:                                 *
* CONNECTION BETWEEN ANALOG GND, DIGITAL GND AND THE  *
* FLOATING SHIELD IS MADE ONLY AT PINS 9 AND 15 OF THE *
* SP674A CONVERTER CHIP.                *
*****************************************
```

| IC POWER/RETURN CHART | | | | | |
|---|---|---|---|---|---|
| IC | | POWER | | RETURN | |
| U27 | 80C152JB | 2 | +5ISO | 3,33 | |
| U35 | X7336 | 21,32,41 | +5ISO | 10,23,31 | |
| U36 | 74HC573 | 20 | +5ISO | 10 | |
| U30 | HM62256 | 28 | +5ISO | 14 | |
| U37 | 27C256 | 32 | +5ISO | 16 | |
| U31 | 74VHC08 | 14 | +5ISO | 7 | |
| U33 | 93C46 | 8 | +5ISO | 5 | |
| U34 | TC7S14F | 5 | +5ISO | 3 | |

| POWER SUPPLY | | | |
|---|---|---|---|
| BYPASS | | | |
| C25 ** | .47 | C33 | .1 |
| C45 | .1 | C47 | .1 |
| C48 | .1 | | |
| C34 | .1 | | |
| C49 | .1 | | |
| C44 | .1 | | |
| C40 | .1 | | |
| C36 | .1 | | |

NOTE: ** DENOTES, 50V,20% CAPACITOR.

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| REFDES | PAGE COORDINATES |
|---|---|
| U1: | 2-D5 |
| U10: | 6-B3<br>8-D3 |
| U11: | 6-D3<br>8-B5 |
| U12: | 5-C3<br>8-C3 |
| U13: | 5-D3<br>8-C5 |
| U14: | 5-C4<br>8-C7 |
| U15: | 5-D4<br>8-D5 |
| U16: | 5-D5<br>8-D2 |
| U17: | 5-C8<br>8-B3 |
| U18: | 5-D8<br>8-C6 |
| U19: | 4-B4<br>8-D7 |
| U2: | 3-B6 |
| U20: | 4-D3<br>8-D6 |
| U21: | 4-D8 |
| U22: | 2-C5<br>9-B8 |
| U23: | 2-B4<br>9-D4 |
| U24: | 2-D2<br>9-C2 |
| U25: | 2-C2<br>9-D2 |
| U26: | 2-D2<br>9-D3 |
| U27: | 2-B2<br>9-C3 |
| U28: | 2-B2<br>9-C4 |
| U29: | 1-D7<br>9-B5 |
| U3: | 3-B6 |
| U30: | 7-D7 |
| U31: | 3-D2<br>9-A5 |
| U32: | 2-C7<br>9-D7 |

| REFDES | PAGE COORDINATES |
|---|---|
| U33: | 1-D2<br>9-A5 |
| U34: | 1-B2 |
| U35: | 1-C5,D8<br>2-D6<br>9-A5 |
| U36: | 1-C4<br>9-A5 |
| U37: | 1-D4<br>9-B5 |
| U38: | 1-A8<br>9-B5 |
| U39: | 1-C3<br>9-A5 |
| U4: | 3-C7,D7<br>9-A5,B2,C2 |
| U40: | 2-D7<br>9-A5 |
| U5: | 3-C4,D4,D6 |
| U6: | 7-C6<br>8-B2 |
| U7: | 6-B5<br>8-B6 |
| U8: | 6-B8<br>8-C2 |
| U9: | 6-D5<br>8-B7 |

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| CONN | LABEL |
|---|---|
| J1-1: | 07071024 |
| J1-10: | ISOAGND |
| J1-13: | +5AISO |
| J1-14: | -5AISO |
| J1-15: | -12AISO |
| J1-16: | +12AISO |
| J1-2: | 07071016 |
| J1-3: | 07071020 |
| J1-4: | RESP_CLK |
| J1-5: | ISOGND |
| J1-6: | ISOGND |
| J1-7: | +5ISO |
| J1-8: | +5ISO |
| J1-9: | ISOAGND |
| J2-1: | ISOAGND |
| J2-10: | BP4_EXC- |
| J2-11: | FSHIELD |
| J2-12: | BP4_SIG+ |
| J2-13: | FSHIELD |
| J2-14: | BP3_SIG+ |
| J2-15: | BP2_SIG- |
| J2-16: | BP1_EXC- |
| J2-17: | 03011027 |
| J2-18: | BP1_SIG+ |
| J2-19: | ISOGND |
| J2-2: | DT/CO_IN1 |
| J2-20: | BP1_SIG- |
| J2-21: | ISOGND |
| J2-22: | BP3_EXC+ |
| J2-23: | BP2_EXC- |
| J2-24: | BP2_SIG+ |
| J2-25: | BP2_EXC+ |
| J2-26: | BP3_EXC- |
| J2-27: | 03011022 |
| J2-28: | BP4_SIG- |
| J2-29: | 03011007 |
| J2-3: | ISOAGND |
| J2-30: | BP3_SIG- |
| J2-31: | 03011017 |
| J2-32: | BP1_EXC+ |
| J2-33: | 03011012 |
| J2-34: | +0.25VREF |
| J2-4: | DT/CO_IN2 |
| J2-5: | 03011037 |
| J2-6: | CO_OFFSET |
| J2-7: | 03011032 |
| J2-8: | BP4_EXC+ |
| J3-1: | A/D_VCAL |
| J3-2: | ISOGND |
| J3-3: | 03043042 |
| J3-4: | ISOAGND |

# Assembly Configurations PN 800330

An older acquisition processor PCB was manufactured with ten configurations. The differences between assemblies are:

- how many blood pressures channels they monitor, and
- how many ECG leadwires they use, and
- whether or not they support noninvasive blood pressure monitoring.

The table below lists the available configurations.

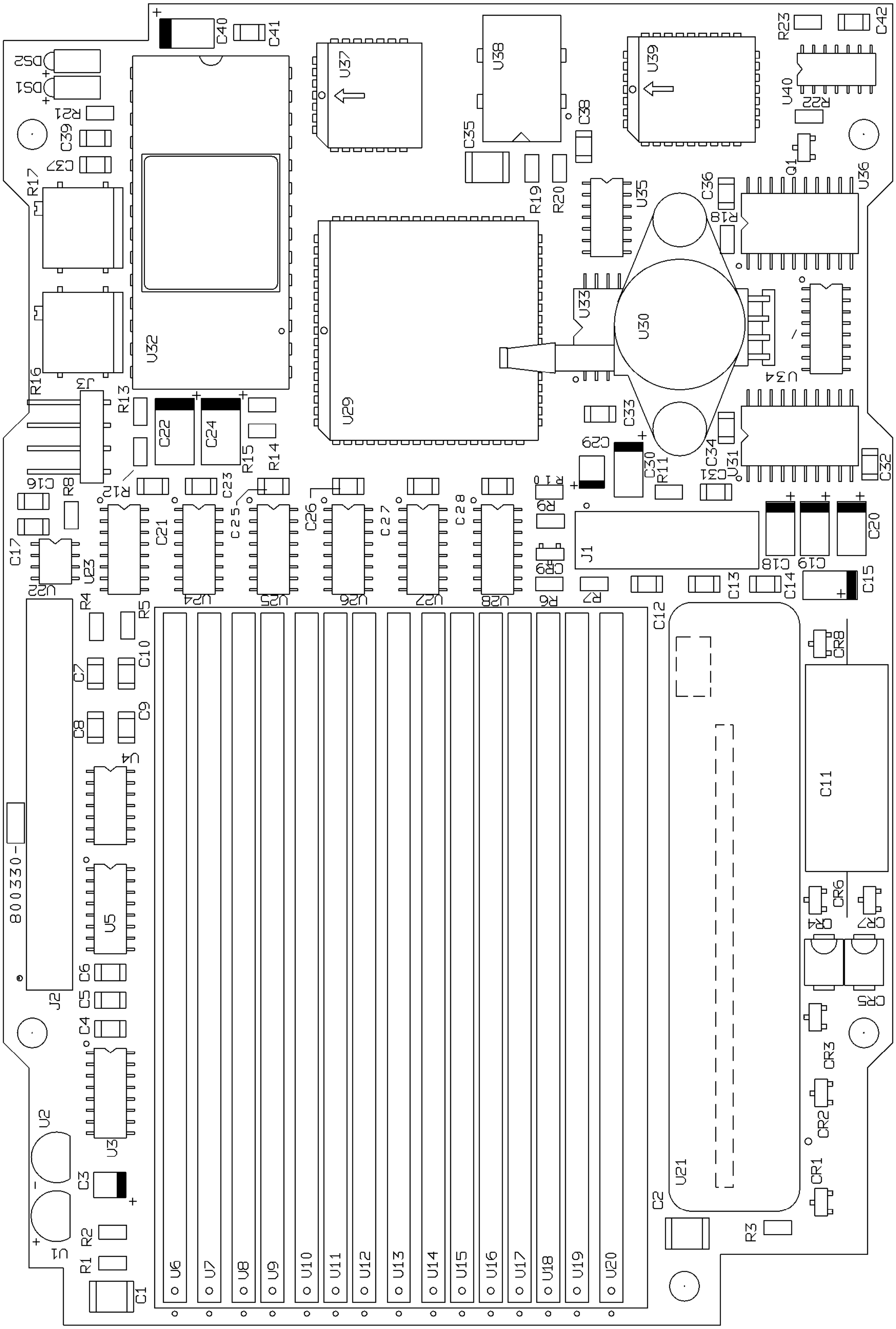
**Table 29-2. Configurations**

| Part Number | Rev | Pressures | ECG Leadwires | NBP |
|---|---|---|---|---|
| 800330-002 | E | 4 | 5 | No |
| 800330-004 | B | 4 | 10 | No |
| 800330-005 | E | 2 | 5 | Yes |
| 800330-006 | B | 2 | 10 | Yes |
| 800330-007 | B | 4 | 10 | Yes |
| 800330-008 | B | 4 | 5 | Yes |
| 800330-009 | D | 3 | 5 | Yes |
| 800330-010 | E | 3 | 10 | Yes |
| 800330-011 | B | 0 | 5 | Yes |
| 800330-012 | B | 0 | 10 | Yes |

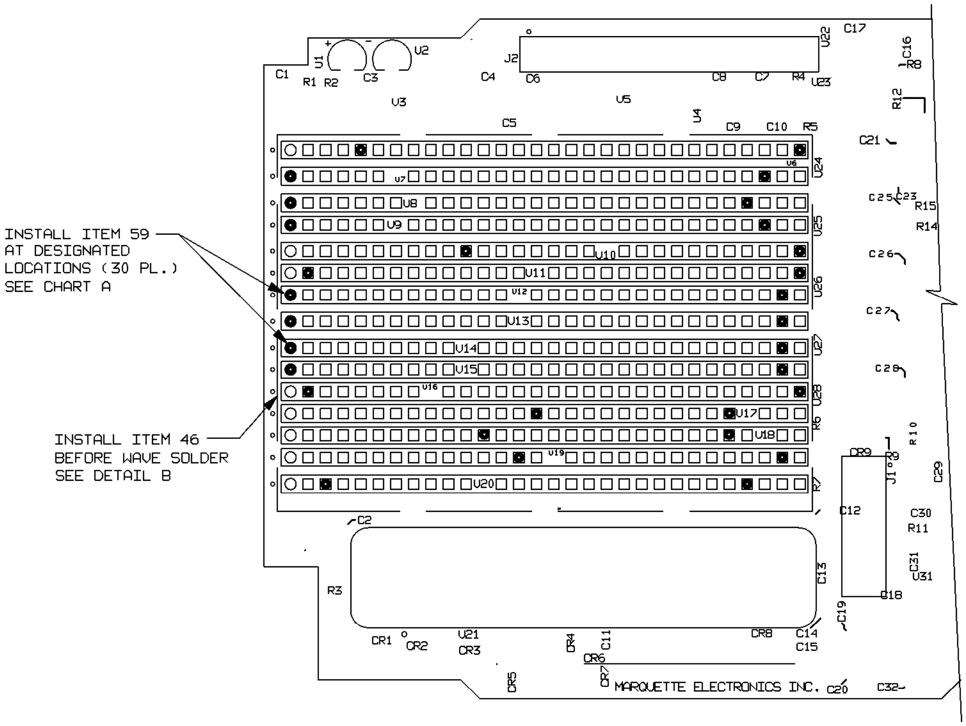
Note that part number 800330 without a dashed suffix (ie, pn 800330, as opposed to pn 800330-001 or pn 800330-002) refers to all of the assemblies listed in the table above. Unless otherwise noted, all assemblies are the same.

# Parts Location Diagram PN 800330B

1 of 2

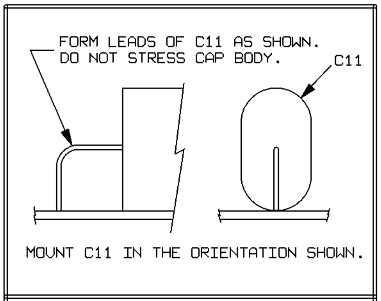

C40
C41
U37
U38
U39
R23
C42
DS2
DS1
R21
C39
C37
R17
U32
C35
C38
R19
R20
U35
C36
R18
U40
R22
Q1
U36
U33
U30
U34
R16
J3
R13
C22
C24
R15
R14
U29
C33
C29
C30
R11
C34
C31
U31
C32
C16
R8
R12
C23
C25
C26
C27
C28
R10
R9
CR9
J1
C18
C19
C20
C17
U23
C21
U22
U24
U25
U26
U27
U28
R6
R7
C13
C14
C15
R4
R5
C12
CR8
C7
C10
C8
C9
C11
U4
800330-
U5
CR6
CR4
CR7
CR5
C6
C5
J2
C4
CR3
U2
U3
CR2
C3
CR1
U21
C2
R3
U1
R2
R1
C1
U6
U7
U8
U9
U10
U11
U12
U13
U14
U15
U16
U17
U18
U19
U20

2 of 2


INSTALL ITEM 59
AT DESIGNATED
LOCATIONS (30 PL.)
SEE CHART A
INSTALL ITEM 46
BEFORE WAVE SOLDER
SEE DETAIL B
C1
R1 R2
U1
C3
U2
U3
C4
J2
C6
C8
C7
R4
U22
U23
C17
C16
R8
R12
U5
U4
C5
C9
C10
R5
C21
U6
U7
U24
U8
C25
C23
R15
U9
U25
R14
U10
C26
U11
U12
U26
C27
U13
U14
U27
C28
U15
U16
U28
U17
R6
U18
R10
U19
CR9
J1
R9
C29
U20
R7
C2
C12
C30
R11
C31
U31
C13
C18
R3
C19
CR1
CR2
U21
CR3
CR4
C11
CR8
C14
C15
CR6
CR5
CR7
MARQUETTE ELECTRONICS INC.
C20
C32

| CHART A | |
|---|---|
| U6 | 5,30 |
| U7 | 1,28 |
| U8 | 1,27 |
| U9 | 1,28 |
| U10 | 11,30 |
| U11 | 2,30 |
| U12 | 1,29 |
| U13 | 1,29 |
| U14 | 1,29 |
| U15 | 1,29 |
| U16 | 2,30 |
| U17 | 15,26 |
| U18 | 12,26 |
| U19 | 14,29 |
| U20 | 3,27 |

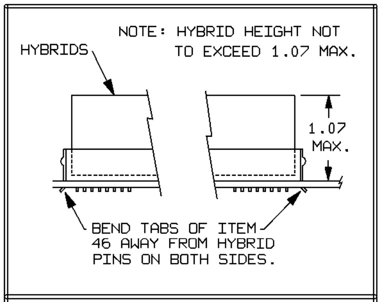
SOCKET PIN LOCATIONS



FORM LEADS OF C11 AS SHOWN. DO NOT STRESS CAP BODY.

MOUNT C11 IN THE ORIENTATION SHOWN.

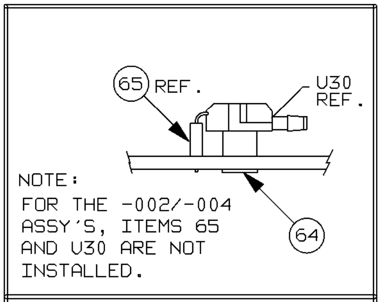
DETAIL A


HYBRIDS
1.07 MAX.

NOTE: HYBRID HEIGHT NOT TO EXCEED 1.07 MAX.

BEND TABS OF ITEM 46 AWAY FROM HYBRID PINS ON BOTH SIDES.

DETAIL B


65 REF.
U30 REF.
64

NOTE:
FOR THE -002/-004 ASSY'S, ITEMS 65 AND U30 ARE NOT INSTALLED.

DETAIL C

# Parts List PN 800330B

| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| C1, 2, 35 | Cap, Cer, 0.47µF, 20% | 1187-474 | 3 |
| C3, 29 | Cap, Tant, 1.0µF, 10%, 35V, SM | 403907-001 | 2 |
| C4-10, 12, 13, 14, 16, 17, 21, 23, 25, 26, 27, 28, 31-34, 36-39, 41, 42 | Cap, Cer, 0.1µF, 20%, 50V | 404370-001 | 28 |
| C11 | Cap, MPE, 10µF, 5%, 35V | 1215-106 | 1 |
| C15, 18, 30, 40 | Cap, Tant, 10µF, 20%, 10V, SM | 1176-106 | 4 |
| C19, 20 | Cap, Tant, 4.7µF, 20%, 20V, SM | 402004-001 | 2 |
| C22, 24 | Cap, Tant, 10µF, 20%, 25V, SM | 1152-106 | 2 |
| CR1 | Diode, SM FDSO1503 | 2414-001 | 1 |
| CR2, 3, 6, 7, 8 | Diode, SM (Not Used on PN 800330-004, -006, -007, -010, and -012) | 2414-001 | 5 |
| CR4, 5 | Transorb, 15V, 5%, 600W SM6T15A | 403188-001 | 2 |
| CR9 | Diode, SM MMAD4148 | 401980-001 | 1 |
| DS1, 2 | Diode, Light-Emitting (Red) | 2498-002 | 2 |
| J1 | Connector, Vertical, 16-Pin | 1847-016 | 1 |
| J2 | Connector, PC Header, 34-Pin, Vertical | 1778-234 | 1 |
| J3 | PC Post, Right Angle | 1778-436 | 4 |
| Q1 | Transistor, PNP, SM T3906 | 2511-101 | 1 |
| R1, 18 | Res, Cer, 100Ω, 1%, 1/8W, SM | 1082-755 | 2 |
| R2 | Res, Cer, 243K, 1%, 1/8W, SM | 1082-798 | 1 |
| R3 | Res, Cer, 499K, 1%, 1/8W, SM | 1082-499 | 1 |
| R4, 5, 8, 9, 20, 23 | Res, Cer, 1K, 1%, 1/8W, SM | 1082-103 | 6 |
| R6, 7, 10, 11 | Res, Cer, 150Ω, 1%, 1/8W, SM | 1082-767 | 4 |
| R12 | Res, Cer, 47.5K, 1%, 1/8W, SM | 1082-757 | 1 |
| R13 | Res, Cer, 2K, 1%, 1/8W, SM | 1082-201 | 1 |
| R14, 15, 19, 21, 22 | Res, Cer, 10K, 1%, 1/8W, SM | 1082-104 | 5 |
| R16, 17 | Res, Var, 100Ω, 12-Turn, Side-Adjust | 403407-001 | 2 |
| SH1 | Shield, Hybrids | 403284-001 | 1 |
| U1 | Sensor, Temperature, TO92 LM35CZ | 403396-001 | 1 |
| U2 | Volt Rgltr, +5V, 0.5%, 100mA, TO92 LP2950 | 402581-001 | 1 |
| U3, 34 | Res Ntwk, 10K | 1062-103 | 2 |
| U4 | Diode Array, SM MMAD130 | 403957-001 | 1 |
| U5 | Res Ntwk, 1K | 1062-102 | 1 |
| U6 | Hybrid, NBP (Not Used on PN 800330-002 or -004) | 404303-001 | 1 |
| U7 | Hybrid, Dual Invasive BP Amplifier (Not Used on PN 800330-005, -006, -011, -012) | 400867-001 | 1 |
| U8 | Hybrid, Quad Invasive BP Driver (Not Used on PN 800330-011, -012) | 401607-001 | 1 |
| U9 | Hybrid, Dual Invasive BP Amplifier (Not Used on PN 800330-011, -012) | 400867-001 | 1 |
| U10 | Hybrid, TEMP, Channel 2 | 402100-004 | 1 |

| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| U11 | Hybrid, TEMP, Channel 1 | 401788-004 | 1 |
| U12 | Hybrid, ECG Final Amplifier (Not Used on PN 800330-002, -005, -008, -009, -011) | 401787-001 | 1 |
| U13 | Hybrid, ECG Final Amplifier | 401787-001 | 1 |
| U14 | Hybrid, ECG Pacemaker Rejection (Not Used on PN 800330-002, -005, -008, -009, -011) | 401786-001 | 1 |
| U15 | Hybrid, ECG Pacemaker Rejection | 401786-001 | 1 |
| U16 | Hybrid, ECG Pacemaker Detection | 401785-001 | 1 |
| U17 | Hybrid, ECG Preamplifier II (Not Used on PN 800330-002, -005, -008, -009, -011) | 401790-001 | 1 |
| U18 | Hybrid, ECG Preamplifier | 400869-004 | 1 |
| U19 | Hybrid, RESP Carrier | 400870-001 | 1 |
| U20 | Hybrid, RESP Demodulator | 400871-004 | 1 |
| U21 | ECG Surge Protection Module | 403993-001 | 1 |
| U22 | Operational Ampl, JFET, SM LT1055 | 402396-001 | 1 |
| U23-28 | Analog Multiplexer, 4-Channel, Dual, SM DG408DY/508DY | 402024-001 | 6 |
| U29 | Microcontroller, Programmed, Communication Control, PLCC 80C152JB | 400368-001 | 1 |
| U30 | Sensor, Pressure, 7.3PSI, Compensated (Not Installed on 800330-002 and -004) | 404406-003 | 1 |
| U31 | Buffer/Driver, Octal, SM HC541 | 401974-001 | 1 |
| U32 | ADC, 12-Bit, Custom | 405548-001 | 1 |
| U33 | RAM, Static, 32K x 8-Bit, SM 62256FLP | 3202-256 | 1 |
| U35 | AND Gate, 2-Input, Quad, SM AC08 | 402717-001 | 1 |
| U36 | Latch, Transparent, Three-State Output, Octal, SM HC573 | 401971-001 | 1 |
| U37 | EPLD, Programmed, Acquisition Processor, PLCC | 404569-002 | 1 |
| U38 | Oscillator, CMOS, 14.7456MHz, SM | 401480-001 | 1 |
| U39 | EPROM, Programmed, Acquisition Processor Boot Code, PLCC | 404905-001 | 1 |
| U40 | EEPROM, Serial NMC93C06 | 402577-001 | 1 |
| - | Socket Hybrids | 403283-002 | 1 |
| - | Socket, 4-Pin (for U30) (Not Installed on PN 800330-002 and -004) | 404939-001 | 1 |
| - | Socket, Mini (for U6-U20) | 1818-201 | 30 |
| - | Spacer Strip, 36-Position (for U30) (Not Installed on PN 800330-002 or -004) | 405598-001 | AR |
| - | Spacer, Round, 6-32 x 1/4 (for U30) (Not Installed on PN 800330-002 and -004) | 4663-604 | 1 |
| - | Circuit Board | 800331-001B | 1 |
| - | Schematic Diagram | SD800330-001B | – |

# Schematic Diagram PN SD800330-001B

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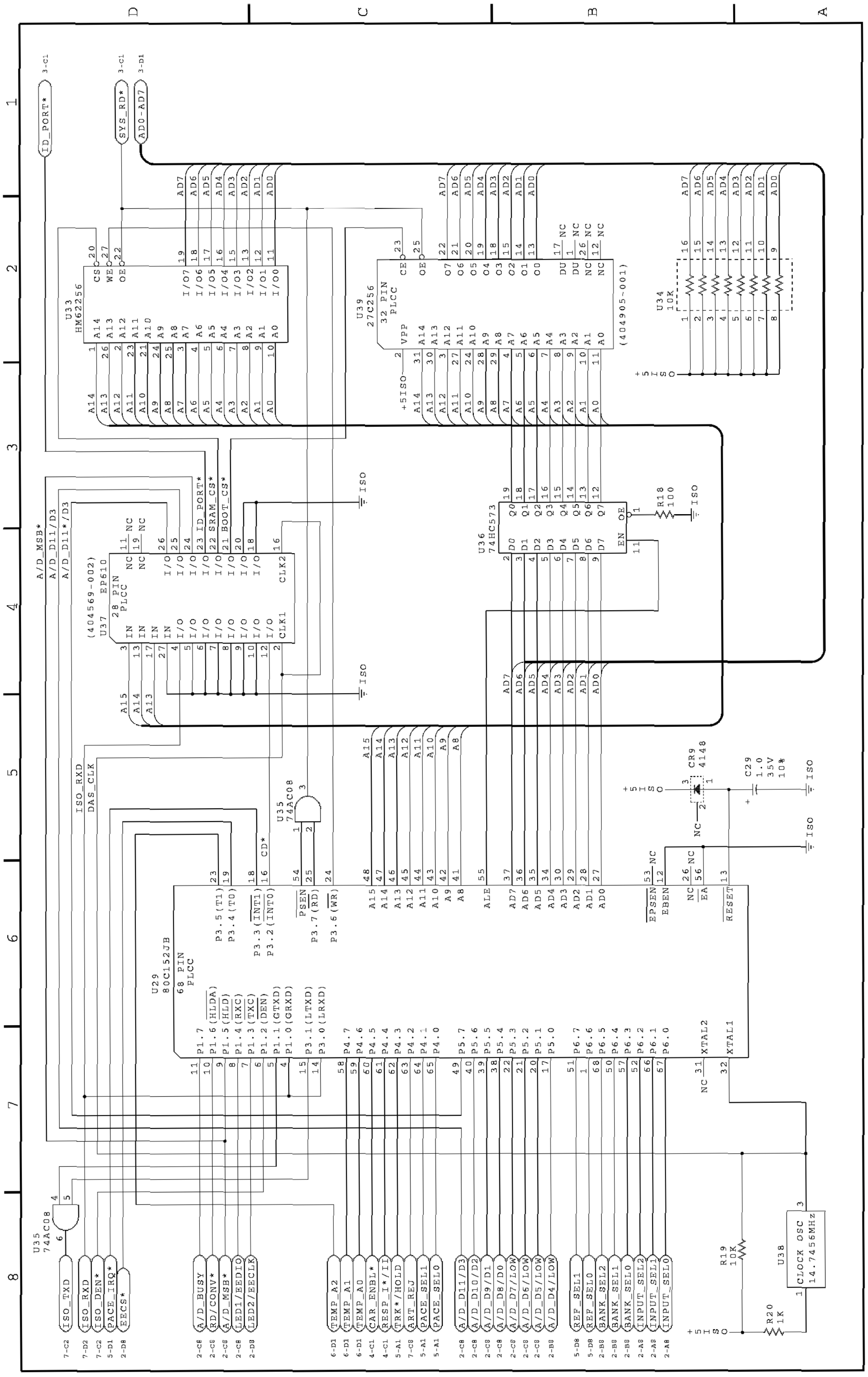
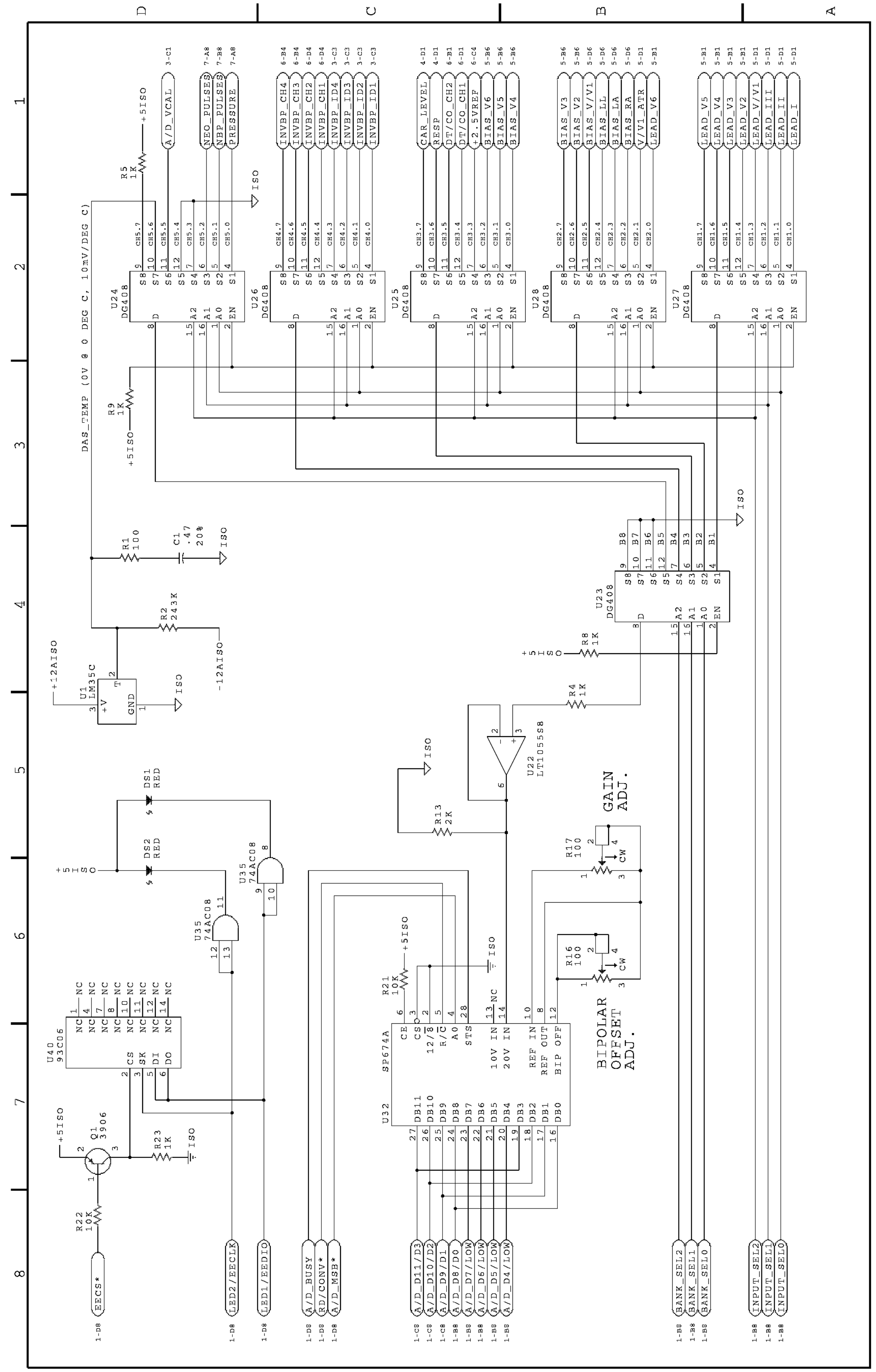

D
C
B
A
1
2
3
4
5
6
7
8
ID_PORT*
SYS_RD*
AD0-AD7
U33
HM62256
U39
27C256
32 PIN
PLCC
(404905-001)
U34
10K
+5ISO
U37
EP610
28 PIN
PLCC
(404569-002)
A/D_MSB*
A/D_D11/D3
A/D_D11*/D3
ID_PORT*
SRAM_CS*
BOOT_CS*
ISO
U36
74HC573
R18
100
ISO_RXD
DAS_CLK
U35
74AC08
CD*
CR9
4148
C29
1.0
35V
10%
U29
80C152JB
68 PIN
PLCC
NC
R19
10K
R20
1K
U38
CLOCK OSC
14.7456MHz
ISO_TXD
ISO_RXD
ISO_DEN*
PACE_IRQ*
EECS*
A/D_BUSY
RD/CONV*
A/D_MSB*
LED1/EEDIO
LED2/EECLK
TEMP_A2
TEMP_A1
TEMP_A0
CAR_ENBL*
RESP_I*/II
TRK*/HOLD
ART_REJ
PACE_SEL1
PACE_SEL0
A/D_D11/D3
A/D_D10/D2
A/D_D9/D1
A/D_D8/D0
A/D_D7/LOW
A/D_D6/LOW
A/D_D5/LOW
A/D_D4/LOW
REF_SEL1
REF_SEL0
BANK_SEL2
BANK_SEL1
BANK_SEL0
INPUT_SEL2
INPUT_SEL1
INPUT_SEL0

## 2 of 11


D
C
B
A
1
2
3
4
5
6
7
8
A/D_VCAL
NEO_PULSES
NBP_PULSES
PRESSURE
INVBP_CH4
INVBP_CH3
INVBP_CH2
INVBP_CH1
INVBP_ID4
INVBP_ID3
INVBP_ID2
INVBP_ID1
CAR_LEVEL
RESP
DT/CO_CH2
DT/CO_CH1
+2.5VREF
BIAS_V6
BIAS_V5
BIAS_V4
BIAS_V3
BIAS_V2
BIAS_V/V1
BIAS_LL
BIAS_LA
BIAS_RA
V/V1_ATR
LEAD_V6
LEAD_V5
LEAD_V4
LEAD_V3
LEAD_V2
LEAD_V/V1
LEAD_III
LEAD_II
LEAD_I
U24 DG408
U26 DG408
U25 DG408
U28 DG408
U27 DG408
U23 DG408
DAS_TEMP (0V @ 0 DEG C, 10mV/DEG C)
R5 1K
R9 1K
R1 100
C1 .47 20%
R2 243K
R8 1K
R4 1K
+5ISO
ISO
+12AISO
-12AISO
U1 LM35C
U22 LT1055S8
R13 2K
GAIN ADJ.
R17 100
R16 100
CW
BIPOLAR OFFSET ADJ.
DS1 RED
DS2 RED
U35 74AC08
U40 93C06
Q1 3906
R23 1K
R22 10K
R21 10K
U32 SP674A
EECS*
LED2/EECLK
LED1/EEDIO
A/D_BUSY
RD/CONV*
A/D_MSB*
A/D_D11/D3
A/D_D10/D2
A/D_D9/D1
A/D_D8/D0
A/D_D7/LOW
A/D_D6/LOW
A/D_D5/LOW
A/D_D4/LOW
BANK_SEL2
BANK_SEL1
BANK_SEL0
INPUT_SEL2
INPUT_SEL1
INPUT_SEL0

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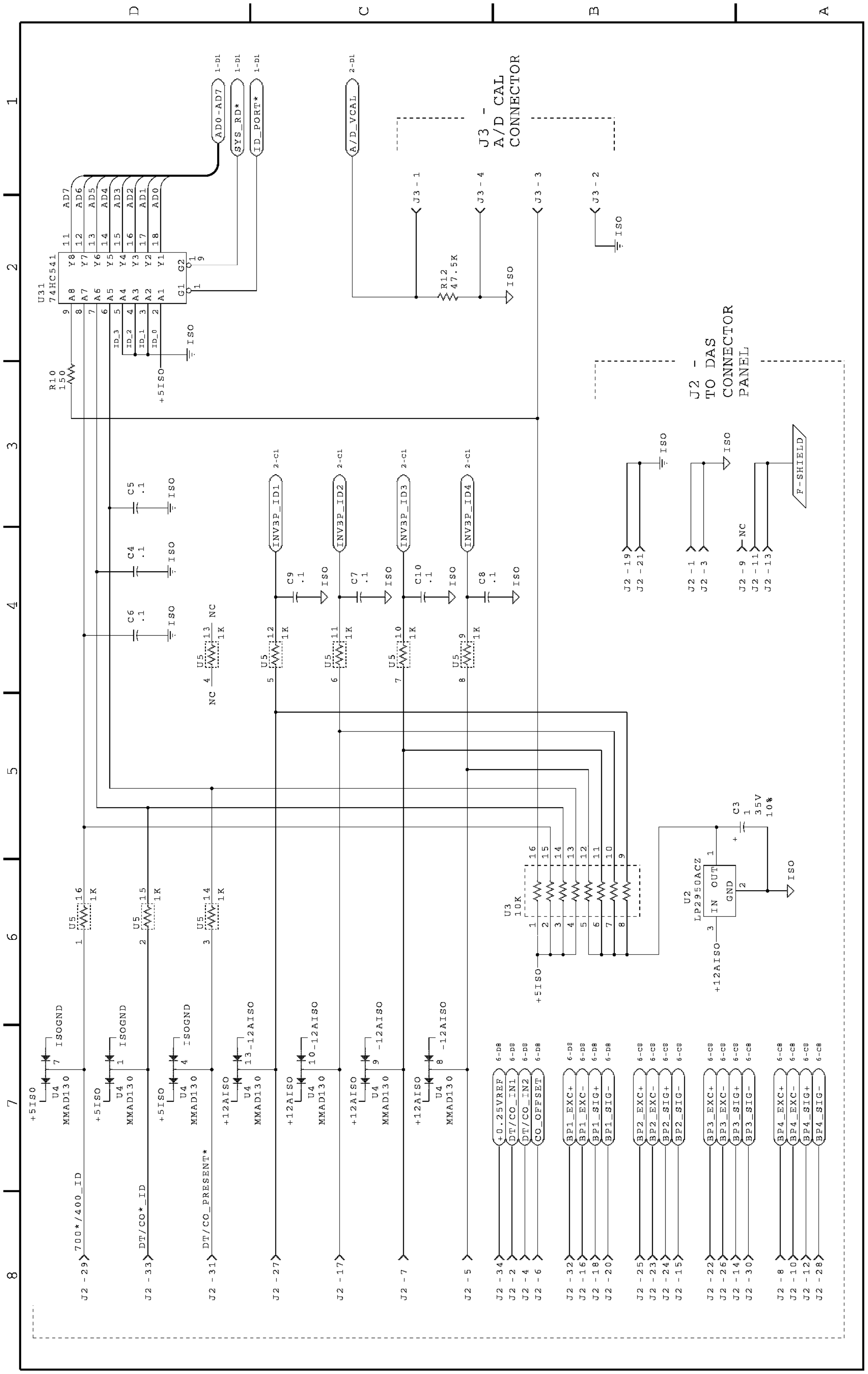
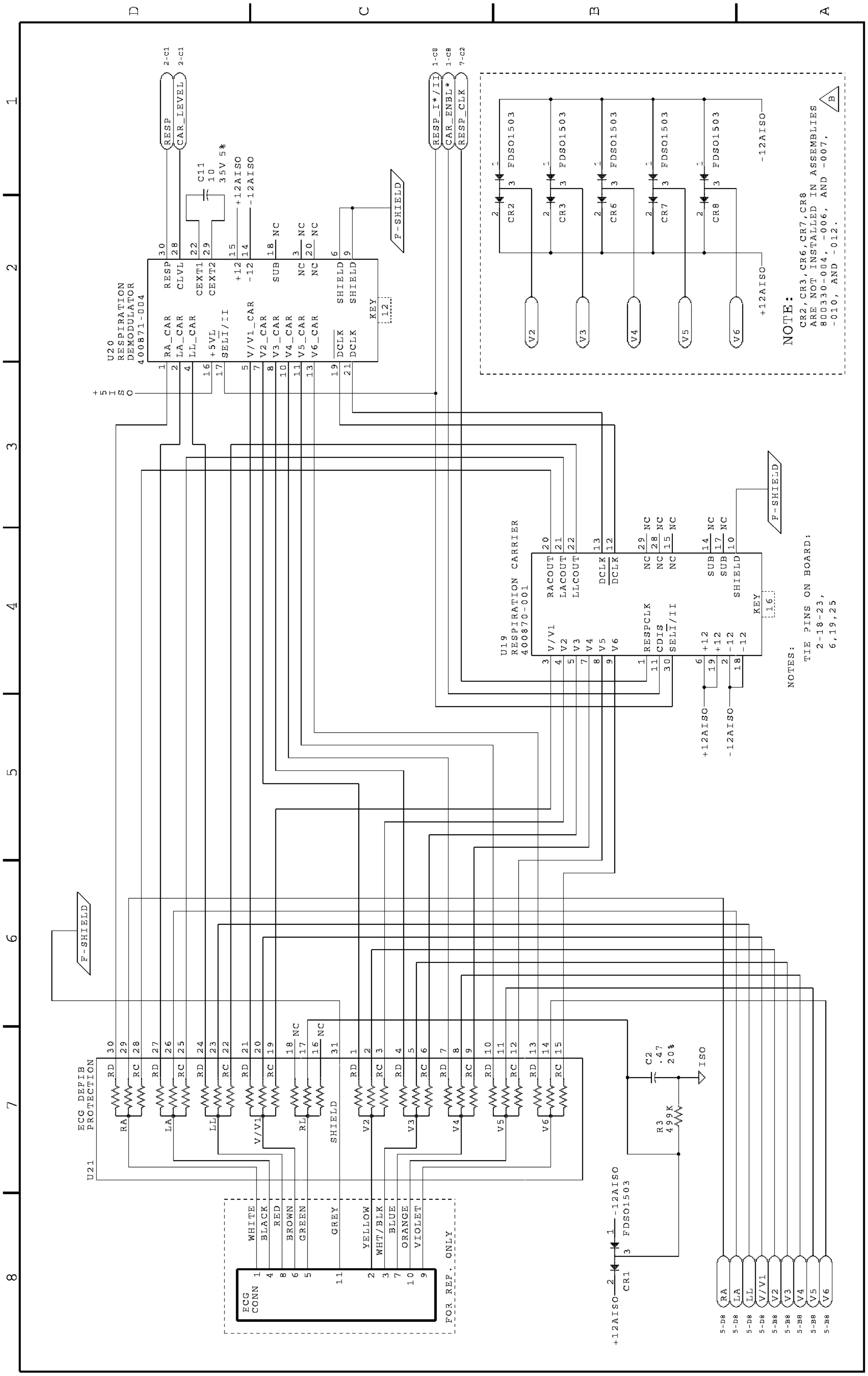

J3 - A/D CAL CONNECTOR
J2 - TO DAS CONNECTOR PANEL
U31 74HC541
AD0-AD7
SYS_RD*
ID_PORT*
A/D_VCAL
R12 47.5K
R10 150
INV3P_ID1
INV3P_ID2
INV3P_ID3
INV3P_ID4
F-SHIELD
U2 LP2950ACZ
C3 1 35V 10%
U3 10K
U4 MMAD130
U5 1K
+5ISO
+12AISO
ISO
ISOGND
700*/400_ID
DT/CO*_ID
DT/CO_PRESENT*
+0.25VREF
DT/CO_IN1
DT/CO_IN2
CO_OFFSET
BP1_EXC+
BP1_EXC-
BP1_SIG+
BP1_SIG-
BP2_EXC+
BP2_EXC-
BP2_SIG+
BP2_SIG-
BP3_EXC+
BP3_EXC-
BP3_SIG+
BP3_SIG-
BP4_EXC+
BP4_EXC-
BP4_SIG+
BP4_SIG-

4 of 11


U20
RESPIRATION
DEMODULATOR
400871-004
RA_CAR
LA_CAR
LL_CAR
+5VL
SELI/II
V/V1_CAR
V2_CAR
V3_CAR
V4_CAR
V5_CAR
V6_CAR
DCLK
DCLK
RESP
CLVL
CEXT1
CEXT2
+12
-12
SUB
NC
NC
SHIELD
SHIELD
KEY
12
RESP
CAR_LEVEL
2-C1
2-C1
C11
10
35V 5%
+12AISO
-12AISO
F-SHIELD
+5ISO
RESP_I*/II
CAR_ENBL*
RESP_CLK
1-C8
1-C8
7-C2
CR2
CR3
CR6
CR7
CR8
FDSO1503
-12AISO
+12AISO
V2
V3
V4
V5
V6
NOTE:
CR2, CR3, CR6, CR7, CR8
ARE NOT INSTALLED IN ASSEMBLIES
800330-004, -006, AND -007,
-010, AND -012.
B
U19
RESPIRATION CARRIER
400870-001
V/V1
V2
V3
V4
V5
V6
RACOUT
LACOUT
LLCOUT
DCLK
DCLK
RESPCLK
CDIS
SELI/II
NC
NC
NC
SUB
SUB
SHIELD
KEY
16
+12
+12
-12
-12
+12AISO
-12AISO
NOTES:
TIE PINS ON BOARD:
2-18-23,
6,19,25
U21
ECG DEFIB
PROTECTION
RD
RC
RA
LA
LL
V/V1
RL
SHIELD
V2
V3
V4
V5
V6
NC
C2
.47
20%
ISO
R3
499K
WHITE
BLACK
RED
BROWN
GREEN
GREY
YELLOW
WHT/BLK
BLUE
ORANGE
VIOLET
ECG
CONN
FOR REF. ONLY
CR1
FDSO1503
+12AISO
-12AISO
RA
LA
LL
V/V1
V2
V3
V4
V5
V6
5-D8
5-B8
A
B
C
D
1
2
3
4
5
6
7
8

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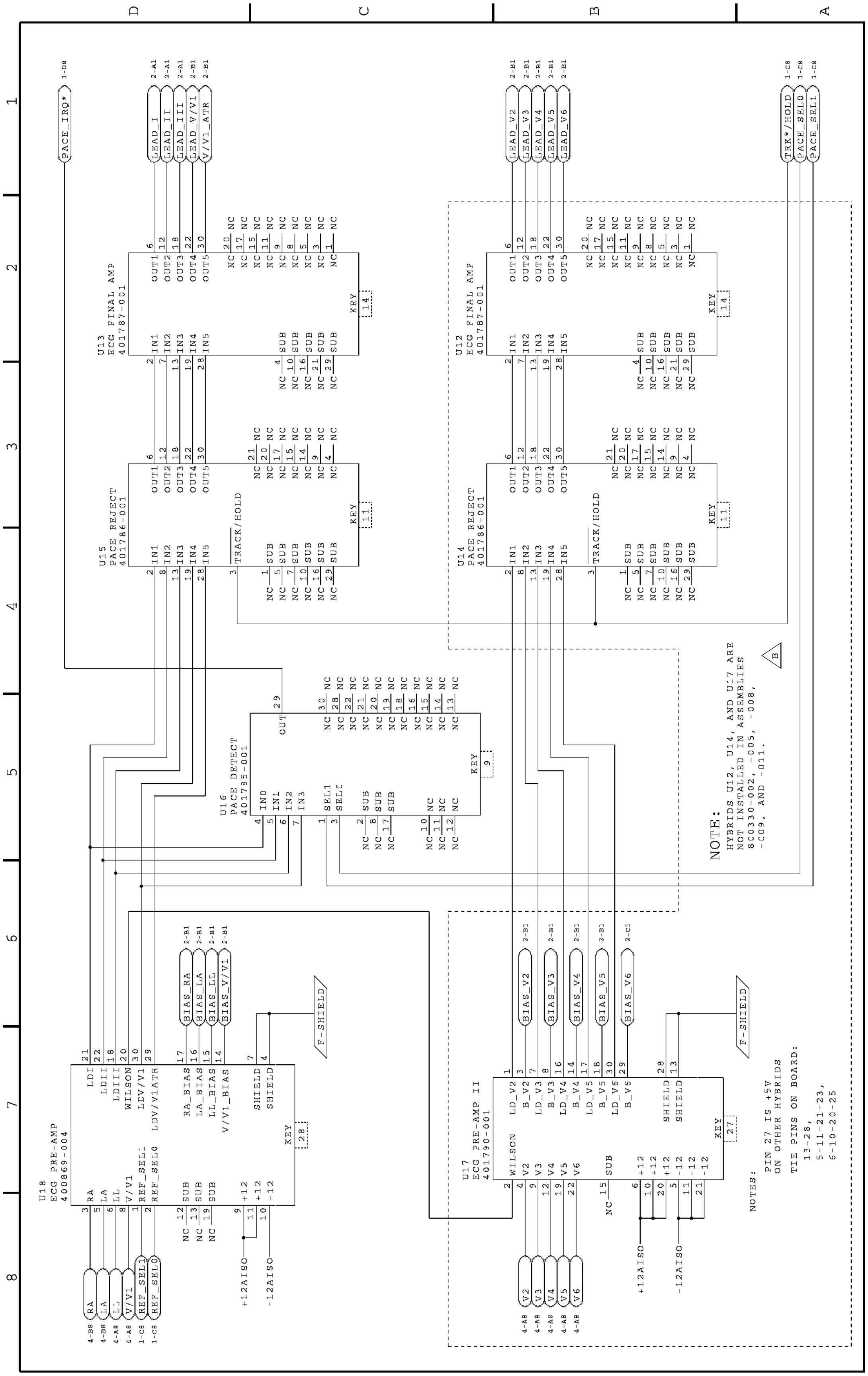
D
C
B
A
1
2
3
4
5
6
7
8
PACE_IRQ* 1-D8
LEAD_I 2-A1
LEAD_II 2-A1
LEAD_III 2-A1
LEAD_V/V1 2-B1
V/V1_ATR 2-B1
LEAD_V2 2-B1
LEAD_V3 2-B1
LEAD_V4 2-B1
LEAD_V5 2-B1
LEAD_V6 2-B1
TRK*/HOLD 1-C8
PACE_SEL0 1-C8
PACE_SEL1 1-C8
U13
ECG FINAL AMP
401787-001
U12
ECG FINAL AMP
401787-001
U15
PACE REJECT
401786-001
U14
PACE REJECT
401786-001
TRACK/HOLD
KEY 14
KEY 11
U16
PACE DETECT
401785-001
KEY 9
IN0
IN1
IN2
IN3
SEL1
SEL0
OUT
NC
SUB
NOTE:
HYBRIDS U12, U14, AND U17 ARE
NOT INSTALLED IN ASSEMBLIES
800330-002, -005, -008,
-009, AND -011.
B
BIAS_RA 2-B1
BIAS_LA 2-B1
BIAS_LL 2-B1
BIAS_V/V1 2-B1
BIAS_V2 2-B1
BIAS_V3 2-B1
BIAS_V4 2-B1
BIAS_V5 2-B1
BIAS_V6 2-C1
F-SHIELD
F-SHIELD
U18
ECG PRE-AMP
400869-004
RA
LA
LL
V/V1
REF_SEL1
REF_SEL0
LDI
LDII
LDIII
WILSON
LDV/V1
LDV/V1ATR
RA_BIAS
LA_BIAS
LL_BIAS
V/V1_BIAS
SHIELD
SHIELD
KEY 28
+12
+12
-12
+12AISO
-12AISO
U17
ECG PRE-AMP II
401790-001
WILSON
LD_V2
B_V2
LD_V3
B_V3
LD_V4
B_V4
LD_V5
B_V5
LD_V6
B_V6
V2
V3
V4
V5
V6
KEY 27
+12
-12
+12AISO
-12AISO
RA 4-B8
LA 4-B8
LL 4-A8
V/V1 4-A8
REF_SEL1 1-C8
REF_SEL0 1-C8
V2 4-A8
V3 4-A8
V4 4-A8
V5 4-A8
V6 4-A8
NOTES:
PIN 27 IS +5V
ON OTHER HYBRIDS
TIE PINS ON BOARD:
13-28,
5-11-21-23,
6-10-20-25

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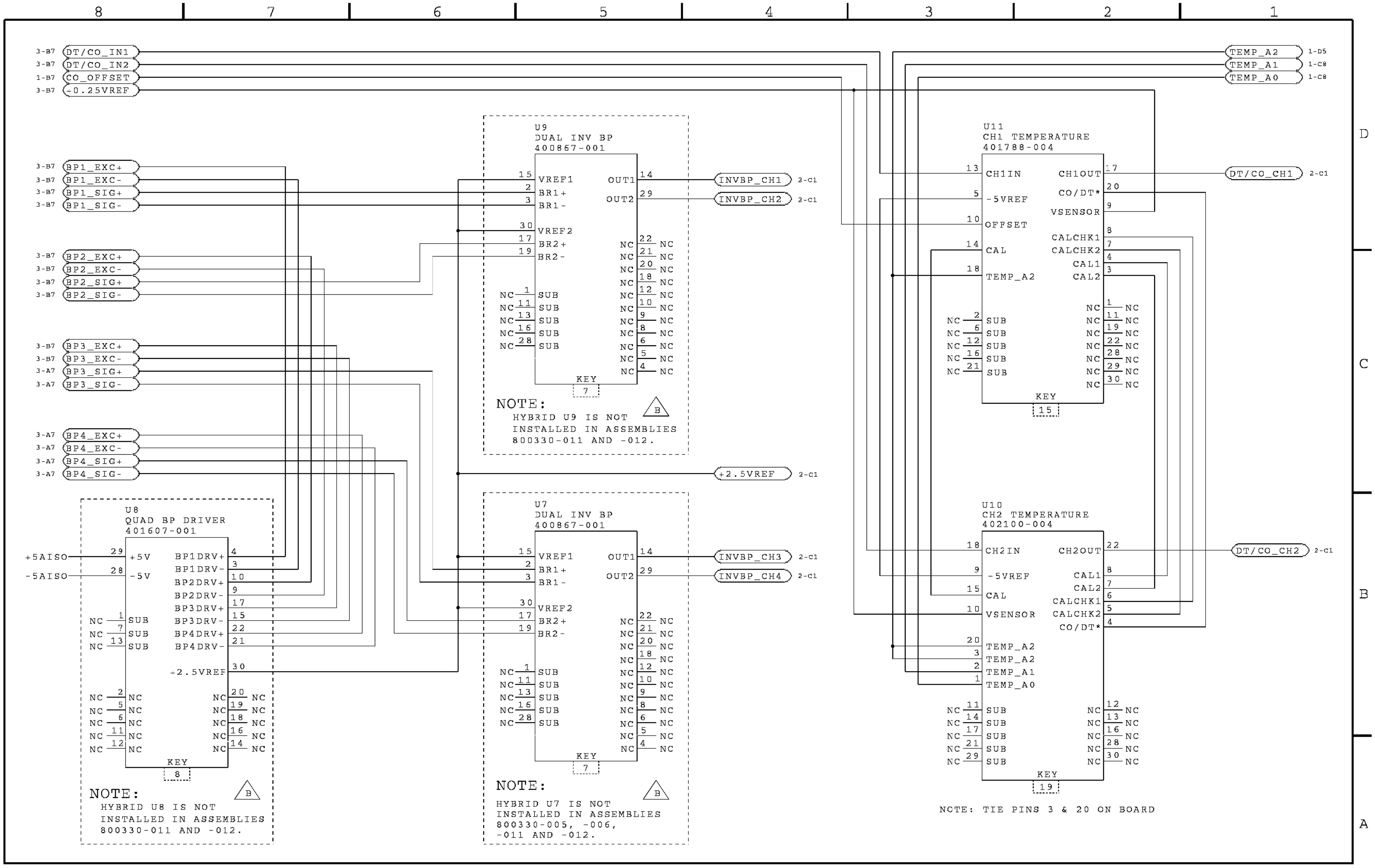
1
2
3
4
5
6
7
8
A
B
C
D
3-B7 DT/CO_IN1
3-B7 DT/CO_IN2
1-B7 CO_OFFSET
3-B7 -0.25VREF
TEMP_A2 1-D5
TEMP_A1 1-C8
TEMP_A0 1-C8
3-B7 BP1_EXC+
3-B7 BP1_EXC-
3-B7 BP1_SIG+
3-B7 BP1_SIG-
3-B7 BP2_EXC+
3-B7 BP2_EXC-
3-B7 BP2_SIG+
3-B7 BP2_SIG-
3-B7 BP3_EXC+
3-B7 BP3_EXC-
3-A7 BP3_SIG+
3-A7 BP3_SIG-
3-A7 BP4_EXC+
3-A7 BP4_EXC-
3-A7 BP4_SIG+
3-A7 BP4_SIG-
U9
DUAL INV BP
400867-001
VREF1
BR1+
BR1-
VREF2
BR2+
BR2-
SUB
OUT1
OUT2
NC
KEY
7
INVBP_CH1 2-C1
INVBP_CH2 2-C1
NOTE:
HYBRID U9 IS NOT INSTALLED IN ASSEMBLIES 800330-011 AND -012.
B
+2.5VREF 2-C1
U7
DUAL INV BP
400867-001
INVBP_CH3 2-C1
INVBP_CH4 2-C1
NOTE:
HYBRID U7 IS NOT INSTALLED IN ASSEMBLIES 800330-005, -006, -011 AND -012.
U8
QUAD BP DRIVER
401607-001
+5AISO
-5AISO
+5V
-5V
BP1DRV+
BP1DRV-
BP2DRV+
BP2DRV-
BP3DRV+
BP3DRV-
BP4DRV+
BP4DRV-
-2.5VREF
KEY
8
NOTE:
HYBRID U8 IS NOT INSTALLED IN ASSEMBLIES 800330-011 AND -012.
U11
CH1 TEMPERATURE
401788-004
CH1IN
-5VREF
OFFSET
CAL
TEMP_A2
CH1OUT
CO/DT*
VSENSOR
CALCHK1
CALCHK2
CAL1
CAL2
KEY
15
DT/CO_CH1 2-C1
U10
CH2 TEMPERATURE
402100-004
CH2IN
-5VREF
CAL
VSENSOR
TEMP_A2
TEMP_A2
TEMP_A1
TEMP_A0
CH2OUT
CAL1
CAL2
CALCHK1
CALCHK2
CO/DT*
KEY
19
DT/CO_CH2 2-C1
NOTE: TIE PINS 3 & 20 ON BOARD

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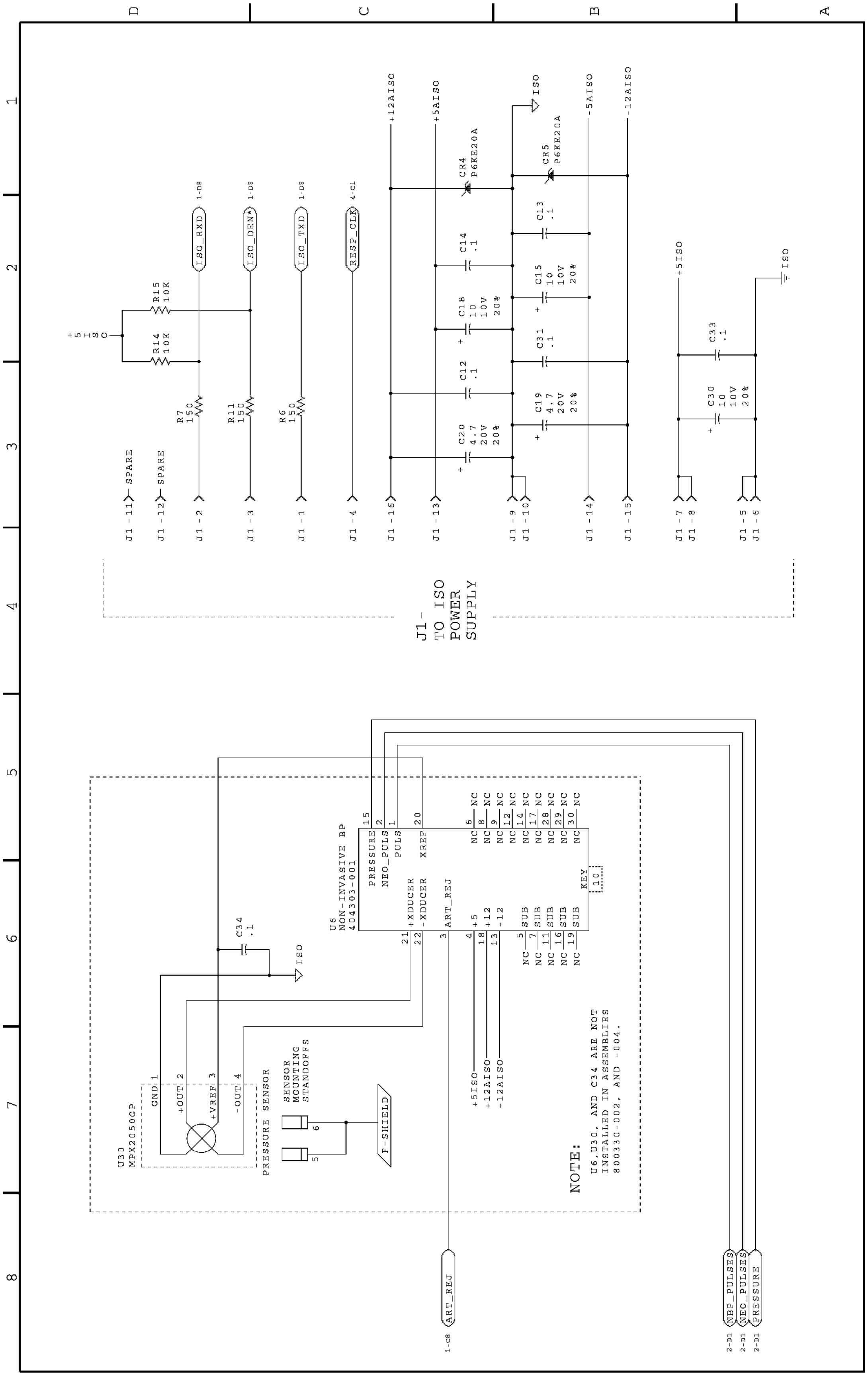
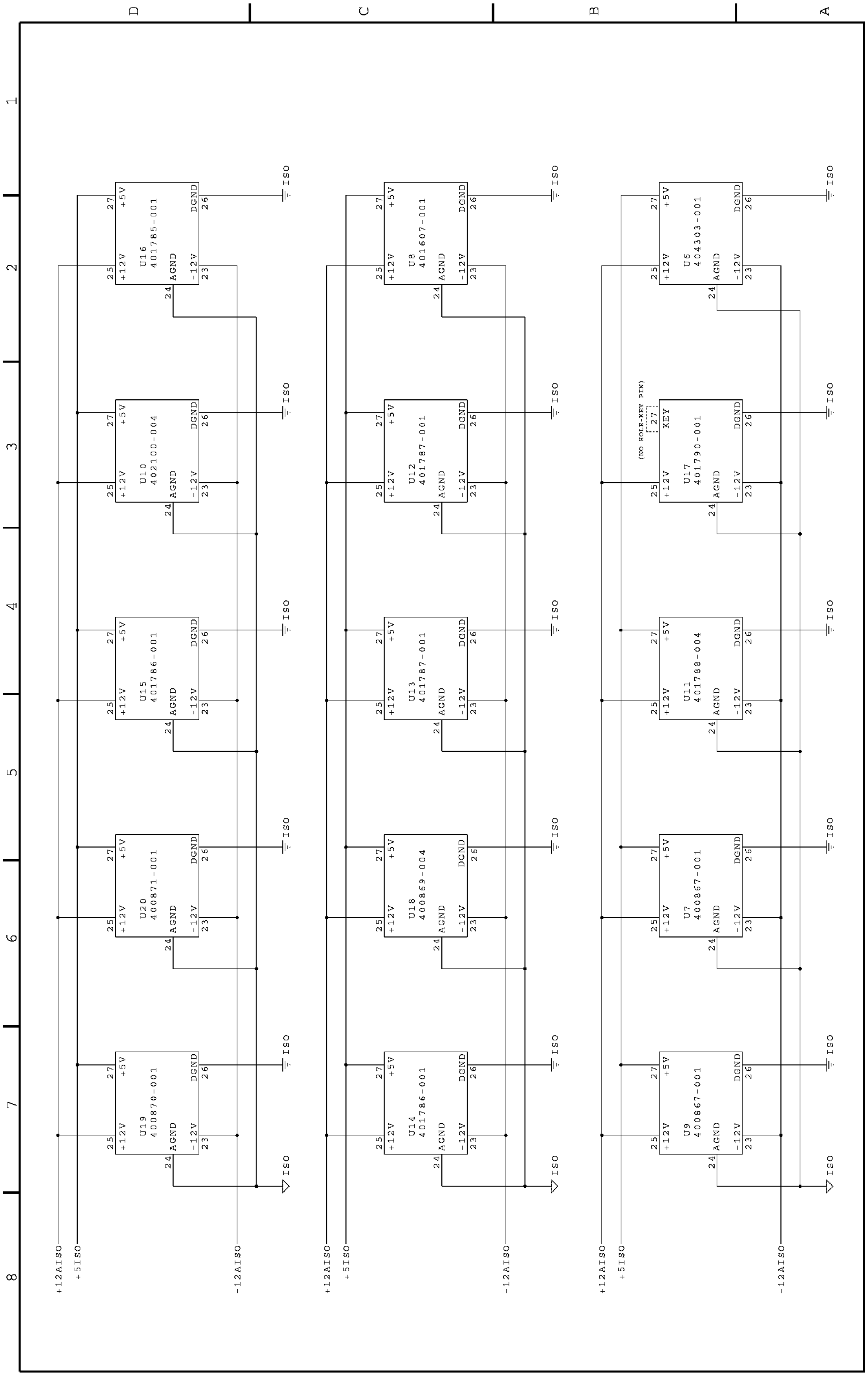
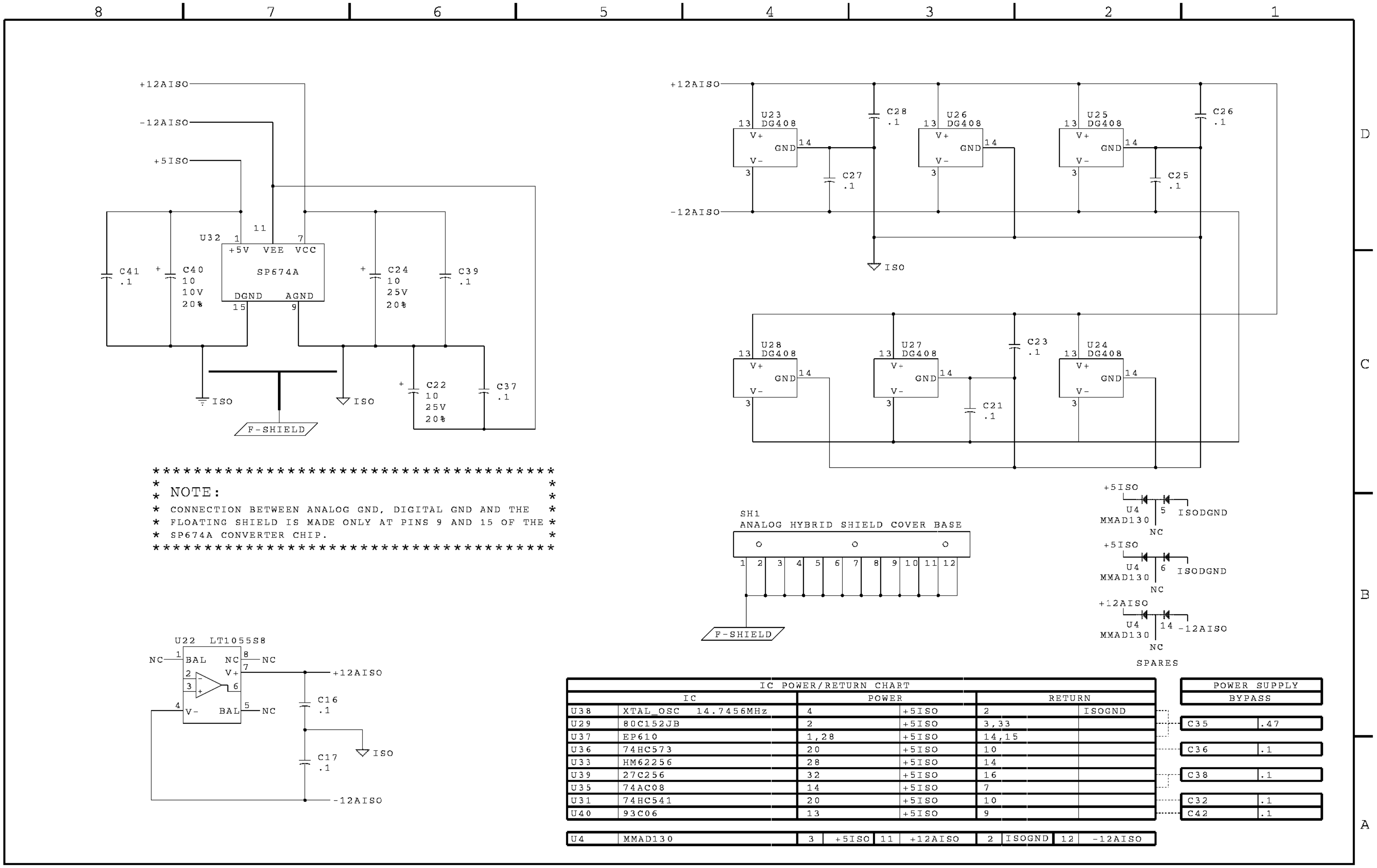

D
C
B
A
1
2
3
4
5
6
7
8
+12AISO
+5AISO
ISO
-5AISO
-12AISO
CR4 P6KE20A
CR5 P6KE20A
C13 .1
C14 .1
C15 10 10V 20%
C18 10 10V 20%
C31 .1
C12 .1
C19 4.7 20V 20%
C20 4.7 20V 20%
C33 .1
C30 10 10V 20%
+5ISO
ISO
ISO_RXD 1-D8
ISO_DEN* 1-D8
ISO_TXD 1-D8
RESP_CLK 4-C1
R15 10K
R14 10K
+5ISO
R7 150
R11 150
R6 150
SPARE
SPARE
J1-11
J1-12
J1-2
J1-3
J1-1
J1-4
J1-16
J1-13
J1-9
J1-10
J1-14
J1-15
J1-7
J1-8
J1-5
J1-6
J1- TO ISO POWER SUPPLY
U6 NON-INVASIVE BP 404303-001
PRESSURE 15
NEO_PULS 2
PULS 1
XREF 20
+XDUCER 21
-XDUCER 22
ART_REJ 3
+5 4
+12 18
-12 13
SUB 5
SUB 7
SUB 11
SUB 16
SUB 19
NC 6
NC 8
NC 9
NC 12
NC 14
NC 17
NC 28
NC 29
NC 30
KEY 10
C34 .1
ISO
U30 MPX2050GP
GND 1
+OUT 2
+VREF 3
-OUT 4
PRESSURE SENSOR
SENSOR MOUNTING STANDOFFS
5
6
P-SHIELD
+5ISO
+12AISO
-12AISO
NOTE:
U6,U30, AND C34 ARE NOT INSTALLED IN ASSEMBLIES 800330-002, AND -004.
ART_REJ 1-C8
NBP_PULSES 2-D1
NEO_PULSES 2-D1
PRESSURE 2-D1

8 of 11


D
C
B
A
1
2
3
4
5
6
7
8
U16
401785-001
U10
402100-004
U15
401786-001
U20
400871-001
U19
400870-001
U8
401607-001
U12
401787-001
U13
401787-001
U18
400869-004
U14
401786-001
U6
404303-001
U17
401790-001
U11
401788-004
U7
400867-001
U9
400867-001
+5V
DGND
+12V
AGND
-12V
KEY
(NO HOLE-KEY PIN)
27
26
25
24
23
ISO
+12AISO
+5ISO
-12AISO

9 of 11


1
2
3
4
5
6
7
8
A
B
C
D
+12AISO
-12AISO
+5ISO
U32
SP674A
+5V
VEE
VCC
DGND
AGND
1
11
7
15
9
C41
.1
C40
10
10V
20%
C24
10
25V
20%
C39
.1
C22
10
25V
20%
C37
.1
ISO
F-SHIELD
U23
DG408
U26
DG408
U25
DG408
U28
DG408
U27
DG408
U24
DG408
V+
V-
GND
13
14
3
C28
.1
C27
.1
C26
.1
C25
.1
C23
.1
C21
.1
ISO
+5ISO
U4
MMAD130
5
ISODGND
NC
6
+12AISO
14
-12AISO
SPARES
SH1
ANALOG HYBRID SHIELD COVER BASE
1
2
3
4
5
6
7
8
9
10
11
12
F-SHIELD
U22
LT1055S8
NC
BAL
V+
V-
2
3
4
5
6
8
C16
.1
C17
.1
ISO

****************************************
* NOTE: *
* CONNECTION BETWEEN ANALOG GND, DIGITAL GND AND THE *
* FLOATING SHIELD IS MADE ONLY AT PINS 9 AND 15 OF THE *
* SP674A CONVERTER CHIP. *
****************************************

| IC POWER/RETURN CHART | | | | | |
|---|---|---|---|---|---|
| IC | | POWER | | RETURN | |
| U38 | XTAL_OSC 14.7456MHz | 4 | +5ISO | 2 | ISOGND |
| U29 | 80C152JB | 2 | +5ISO | 3,33 | |
| U37 | EP610 | 1,28 | +5ISO | 14,15 | |
| U36 | 74HC573 | 20 | +5ISO | 10 | |
| U33 | HM62256 | 28 | +5ISO | 14 | |
| U39 | 27C256 | 32 | +5ISO | 16 | |
| U35 | 74AC08 | 14 | +5ISO | 7 | |
| U31 | 74HC541 | 20 | +5ISO | 10 | |
| U40 | 93C06 | 13 | +5ISO | 9 | |
| U4 | MMAD130 | 3<br>11 | +5ISO<br>+12AISO | 2<br>12 | ISOGND<br>-12AISO |

| POWER SUPPLY BYPASS | |
|---|---|
| C35 | .47 |
| C36 | .1 |
| C38 | .1 |
| C32 | .1 |
| C42 | .1 |

10 of 11

8 7 6 5 4 3 2 1

D C B A

| REFDES | PAGE COORDINATES |
|---|---|
| U1: | 2-D5 |
| U10: | 6-B3<br>8-D3 |
| U11: | 6-D3<br>8-B5 |
| U12: | 5-C3<br>8-C3 |
| U13: | 5-D3<br>8-C5 |
| U14: | 5-C4<br>8-C7 |
| U15: | 5-D4<br>8-D5 |
| U16: | 5-D5<br>8-D2 |
| U17: | 5-C8<br>8-B3 |
| U18: | 5-D8<br>8-C6 |
| U19: | 4-B4<br>8-D7 |
| U2: | 3-B6 |
| U20: | 4-D3<br>8-D6 |
| U21: | 4-D8 |
| U22: | 2-C5<br>9-B8 |
| U23: | 2-B4<br>9-D4 |
| U24: | 2-D2<br>9-C2 |
| U25: | 2-C2<br>9-D2 |
| U26: | 2-D2<br>9-D3 |
| U27: | 2-B2<br>9-C3 |
| U28: | 2-B2<br>9-C4 |
| U29: | 1-D7<br>9-B5 |
| U3: | 3-B6 |
| U30: | 7-D7 |
| U31: | 3-D2<br>9-A5 |
| U32: | 2-C7<br>9-D7 |
| U33: | 1-D2<br>9-A5 |
| U34: | 1-B2 |
| U35: | 1-C5,D8<br>2-D6<br>9-A5 |
| U36: | 1-C4<br>9-A5 |
| U37: | 1-D4<br>9-B5 |
| U38: | 1-A8<br>9-B5 |
| U39: | 1-C3<br>9-A5 |
| U4: | 3-C7,D7<br>9-A5,B2,C2 |
| U40: | 2-D7<br>9-A5 |
| U5: | 3-C4,D4,D6 |
| U6: | 7-C6<br>8-B2 |
| U7: | 6-B5<br>8-B6 |
| U8: | 6-B8<br>8-C2 |
| U9: | 6-D5<br>8-B7 |

11 of 11

| CONN | LABEL |
|---|---|
| J1-1: | 07071024 |
| J1-10: | ISOAGND |
| J1-13: | +5AISO |
| J1-14: | -5AISO |
| J1-15: | -12AISO |
| J1-16: | +12AISO |
| J1-2: | 07071016 |
| J1-3: | 07071020 |
| J1-4: | RESP_CLK |
| J1-5: | ISOGND |
| J1-6: | ISOGND |
| J1-7: | +5ISO |
| J1-8: | +5ISO |
| J1-9: | ISOAGND |
| J2-1: | ISOAGND |
| J2-10: | BP4_EXC- |
| J2-11: | FSHIELD |
| J2-12: | BP4_SIG+ |
| J2-13: | FSHIELD |
| J2-14: | BP3_SIG+ |
| J2-15: | BP2_SIG- |
| J2-16: | BP1_EXC- |
| J2-17: | 03011027 |
| J2-18: | BP1_SIG+ |
| J2-19: | ISOGND |
| J2-2: | DT/CO_IN1 |
| J2-20: | BP1_SIG- |
| J2-21: | ISOGND |
| J2-22: | BP3_EXC+ |
| J2-23: | BP2_EXC- |
| J2-24: | BP2_SIG+ |
| J2-25: | BP2_EXC+ |
| J2-26: | BP3_EXC- |
| J2-27: | 03011022 |
| J2-28: | BP4_SIG- |
| J2-29: | 03011007 |
| J2-3: | ISOAGND |
| J2-30: | BP3_SIG- |
| J2-31: | 03011017 |
| J2-32: | BP1_EXC+ |
| J2-33: | 03011012 |
| J2-34: | +0.25VREF |
| J2-4: | DT/CO_IN2 |
| J2-5: | 03011037 |
| J2-6: | CO_OFFSET |
| J2-7: | 03011032 |
| J2-8: | BP4_EXC+ |
| J3-1: | A/D_VCAL |
| J3-2: | ISOGND |
| J3-3: | 03043042 |
| J3-4: | ISOAGND |

# 30

# PULSE OXIMETRY PCB PN 414409/800674/401198

**General** .......................................................................... 30-2

**Exploded View PN 414409-001B** ................................................... 30-3

**Parts List PN 414409-001C** ........................................................... 30-4

**Parts Location Diagram PN 800674-003A** ....................................... 30-5

**Parts List PN 800674-003A** ........................................................... 30-7

**Schematic Diagram PN SD800674-003A** ....................................... 30-10

**Assembly Revisions PN 800674** ................................................... 30-19

**Parts Location Diagram PN 800674-001A/002B** ............................ 30-20

**Parts List PN 800674-001A/002B** ................................................. 30-22

**Schematic Diagram PN SD800674-002A** ....................................... 30-25

# General

For Tram 250, 450, 650, and 850 modules, the circuit board, pn 800674-00X, supports MEI and Nellcor $SpO_2$ probes and is produced by Marquette Medical Systems. The encasing housing assembly for the circuit board is pn 414409-001.

**NOTE**
The pulse oximetry PCB may also be referred to as $SpO_2$ PCB.

There are two different versions of the pulse oximetry PCB:

- pn 800674-001, which was first used in all of the A-series modules,
- pn 800674-002, which was introduced in the SL-series modules, and then added to the A-series modules, and
- pn 800674-003, which is currently used for all modules.

**NOTE**
Replace version -001 or -002 circuit board with a -003 circuit board, but do not replace a -003 with a -001 or -002 circuit board.

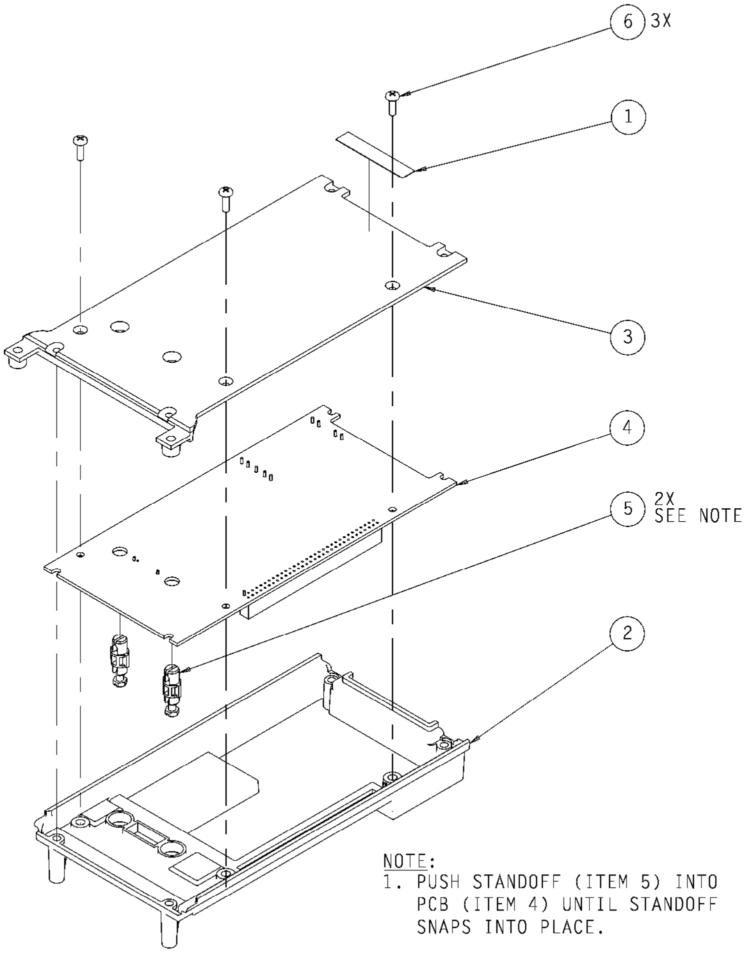
For Tram 200, 400, 600, and 800 modules, the PCB, pn 401189-001, supports Ohmeda probes and is produced by Ohmeda. Ohmeda supports this circuit board with an interface manual. The manual includes schematic diagrams, theory of operation, and troubleshooting to the component level.

For service information about the Ohmeda circuit board, the manual, *Ohmeda MINX Module Interface Manual*, pn 1128-304, is only available directly from the following address.

Ohmeda
1315 West Century Drive
Louisville, CO 80027
Phone: (303) 666-7001
(800) 652-2469
Fax: 303) 665-9231
Telex: 296 445 BTI UR

For more details about the interconnect circuit board between the Ohmeda circuit board and the power indicator circuit board, refer to chapter 25.

# Exploded View PN 414409-001C



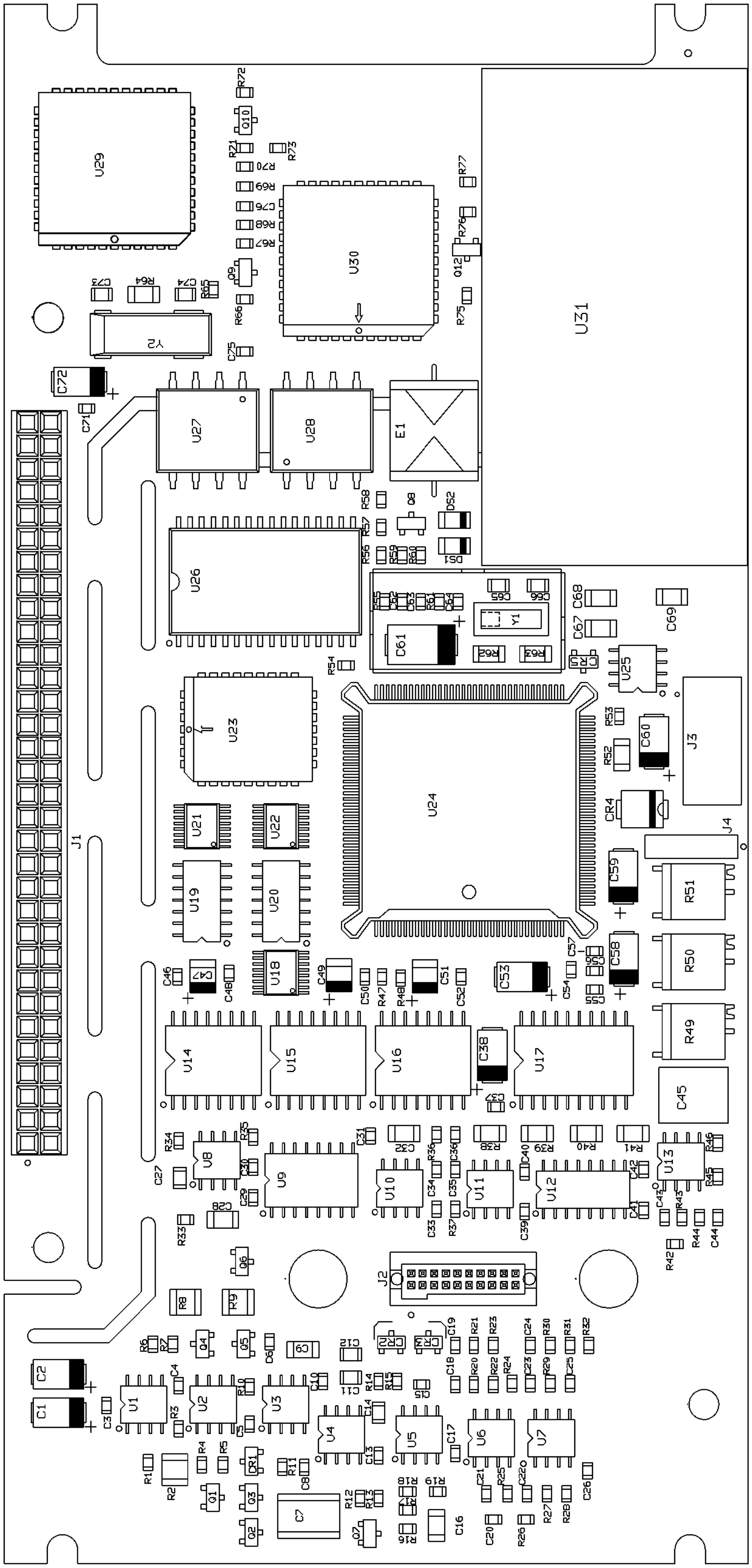
NOTE:
1. PUSH STANDOFF (ITEM 5) INTO PCB (ITEM 4) UNTIL STANDOFF SNAPS INTO PLACE.

# Parts List PN 414409-001C

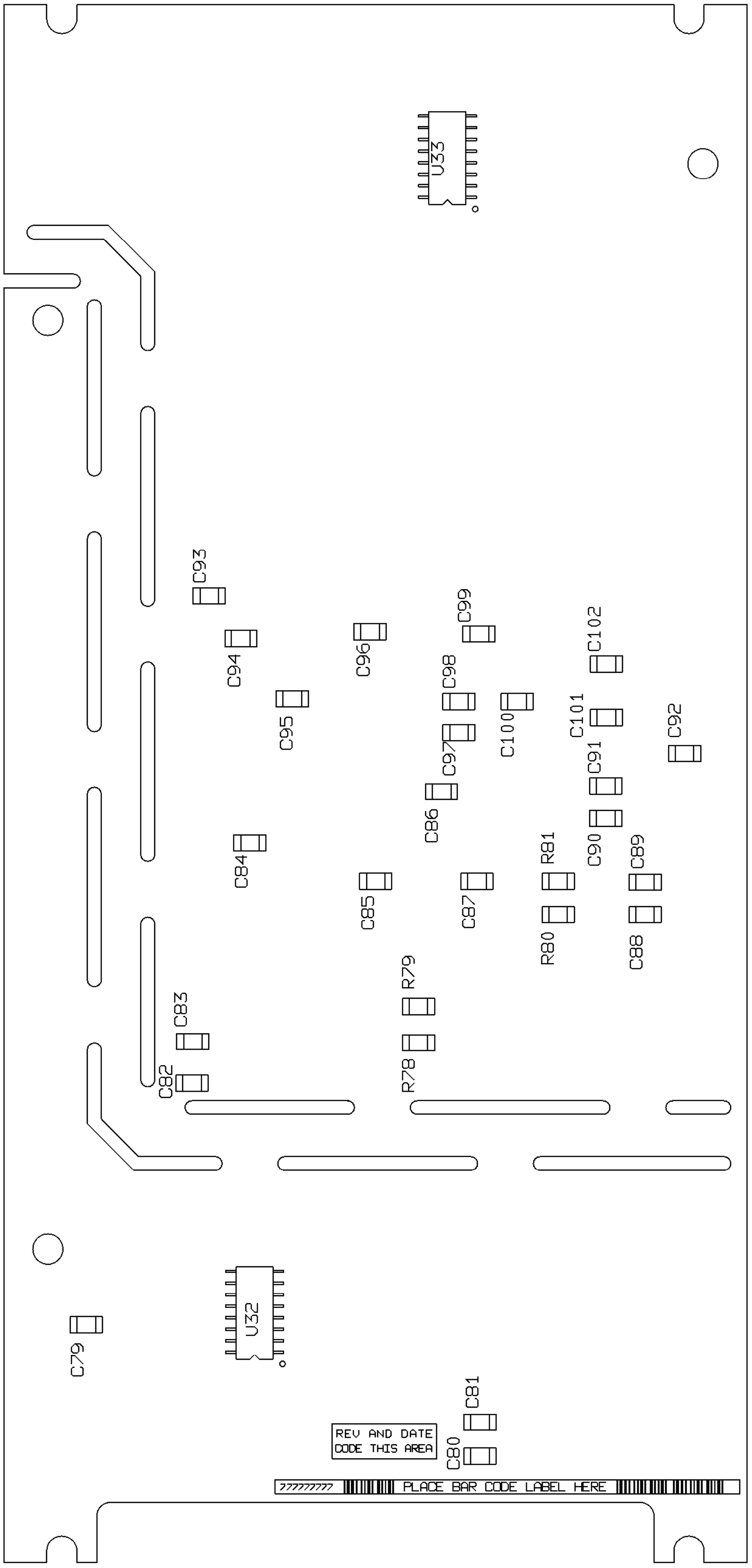
| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| 1 | Label | 407132-002 | 1 |
| 2 | Housing, Pulse Oximetry | 412219-003 | 1 |
| 3 | Cover, Pulse Oximetry | 412248-001 | 1 |
| 4 | Pulse Oximetry PCB | 800674-003 | 1 |
| 5 | Standoff, 1/4-Turn, 0.25 | 413454-001 | 2 |
| 6 | Screw, BDGH, 4-40 x 3/8 | 45074-412 | 3 |
| 1 | Label | 407132-002 | 1 |

# Parts Location Diagram PN 800674-003A

1 of 2


U29
U30
U31
Y2
U27
U28
E1
U26
Y1
C61
U25
J3
U23
U24
CR4
J4
U21
U22
U19
U20
R51
R50
R49
U18
C53
U14
U15
U16
U17
C38
C45
J1
U8
U9
U10
U11
U12
U13
J2
R8
R9
C2
C1
U1
U2
U3
U4
U5
U6
U7
C7

2 of 2


U33
C93
C94
C96
C99
C102
C98
C95
C100
C101
C92
C97
C91
C86
C90
R81
C89
C84
C85
C87
R80
C88
R79
C83
C82
R78
C79
U32
C81
C80
REV AND DATE
CODE THIS AREA
PLACE BAR CODE LABEL HERE

# Parts List PN 800674-003A

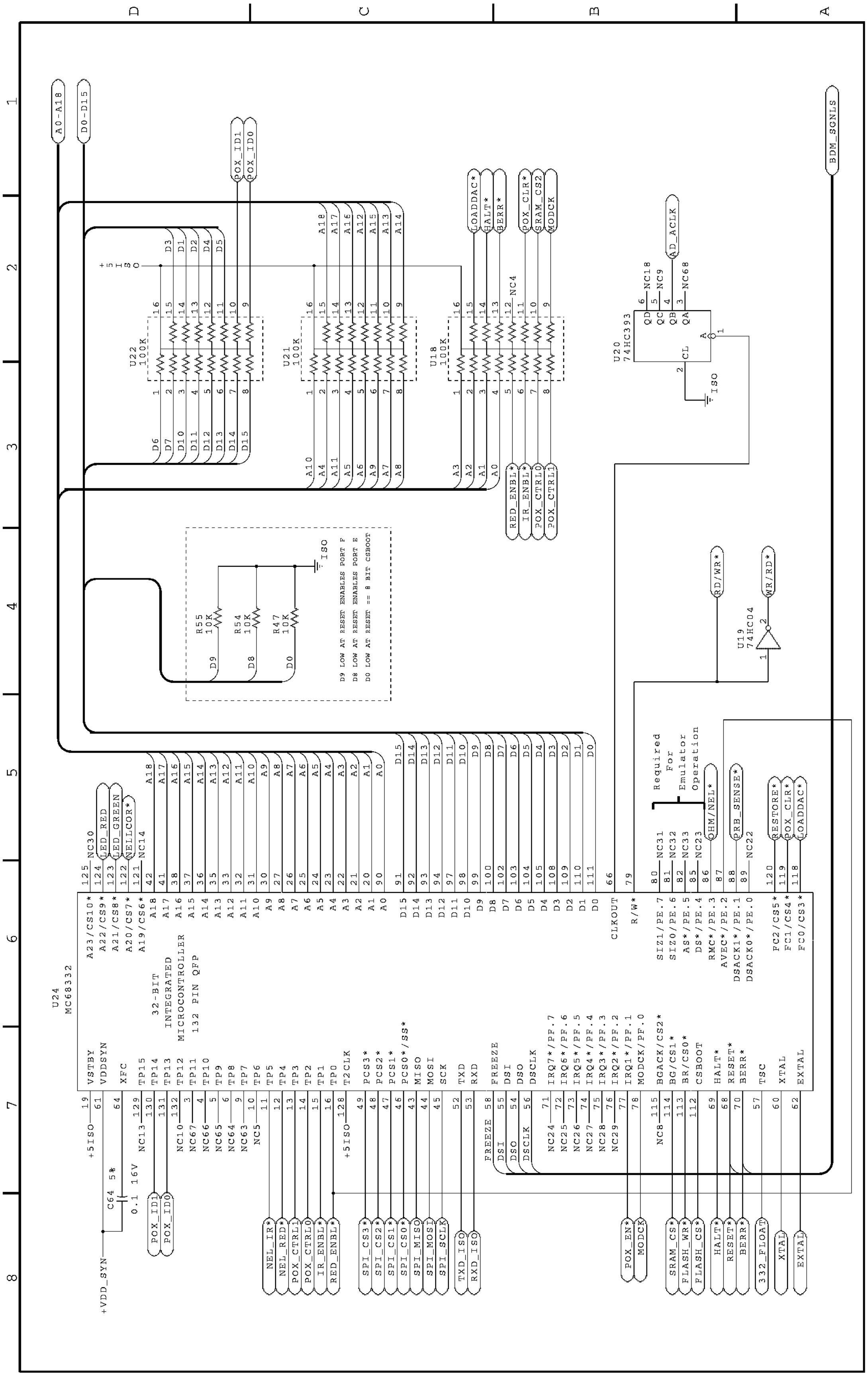
| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| C1, 2, 38, 53, 58-60, 72 | Cap, Tant, 10µF, 20%, 16V, SM | 1176-106 | 8 |
| C3, 20, 22, 24, 25, 34, 36, 43, 46, 48, 50, 52, 57, 62, 71 | Cap, Cer, 0.1µF, 5%, 50V | 411575-012 | 15 |
| C4-6, 8, 10, 13, 15, 17-19, 21, 23, 26, 29-31, 33, 35, 37, 39, 40-42, 44, 54-56, 63, 64, 75, 76 | Cap, Cer, 0.1µF, 5%, 16V | 411575-002 | 31 |
| C7 | Cap, Cer, 0.33µF, 5%, 50V | 1181-334 | 1 |
| C9, 28, 32 | Cap, Cer, 0.0015µF, 5%, SM | 1181-152 | 3 |
| C11 | Cap, Cer, 470pF, 5%, 50V, SM | 1181-471 | 1 |
| C12 | Cap, Cer, 0.001µF, 5%, 50V, SM | 1181-102 | 1 |
| C14, 65, 66, 73, 74 | Cap, Cer, 22pF, 5%, 50V, SM | 1181-220 | 5 |
| C16 | Cap, Cer, 0.1µF, 5%, 50V, SM | 1182-104 | 1 |
| C27 | Cap, Cer, 150pF, 5%, 50V, SM | 1181-151 | 1 |
| C45 | Cap, PP, 0.01µF, 1%, 63V | 408822-001 | 1 |
| C47, 49, 51 | Cap, Tant, 1.0µF, 10%, 35V, SM | 403907-001 | 3 |
| C61 | Cap, Tant, 47µF, 20%, 10V, SM | 405585-001 | 1 |
| C67, 69, 79, 81-87, 89-102 | Cap, Cer, 0.1µF, 20%, 50V | 404370-001 | 24 |
| C68, 80, 88 | Cap, Cer, 0.01µF, 5%, 50V, SM | 400265-001 | 3 |
| CR1 | Diode, SM MMAD4148 | 401980-001 | 1 |
| CR2, 3 | Diode, SM FDSO1503 | 2414-001 | 2 |
| CR4 | Diode, Schottky, Barrier, 1A, 40V, SM MBRS140T3 | 403187-001 | 1 |
| CR5 | Diode, Schottky, SM BAT54 | 401985-001 | 1 |
| DS1 | Diode, Light-Emitting (Green) | 414417-004 | 1 |
| DS2 | Diode, Light-Emitting (Red) | 414417-002 | 1 |
| E1 | Surge Protector, 7.5kV, ±15% | 1931-001 | 1 |
| J1 | Connector, PC Header, 64-Pin | 1847-064 | 1 |
| J2 | Connector, PC Header, 20-Pin, SM | 413053-002 | 1 |
| J3 | PC Post, 2 x 5-Pin | 413864-001 | 1 |
| J4 | PC Post, 1 x 4-Pin | 413864-002 | 1 |
| Q1, 4 | Transistor, PNP, SM T2907A | 405759-001 | 2 |
| Q2, 5 | Transistor, NPN, SM MMBT222 | 404927-001 | 2 |
| Q3, 6 | Transistor, MOSFET, N-Channel, Enhancement Mode, SM VN0605T | 406267-001 | 2 |
| Q7 | Transistor, JFET, P-Channel, SM MMBFJ117 | 404417-001 | 1 |
| Q8, 9 | Transistor, PNP, SM T3906 | 2511-101 | 2 |
| Q10, 12 | Transistor, NPN, SM T3904 | 2511-001 | 2 |
| R1, 7, 48 | Res, Cer, 100K, 1%, 1/16W, SM | 410334-019 | 3 |
| R2, 8, 9 | Res, Cer, 10.0K, 1%, 1/4W | 407468-002 | 3 |

| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| R3, 11, 20-23, 27, 28, 30, 32, 43, 47, 53-55, 57, 60, 65, 68-73, 75-77 | Res, Cer, 10K, 1%, 1/16W, SM | 410334-013 | 27 |
| R4-6, 10 | Res, Cer, 4.75K, 1%, 1/16W, SM | 410334-010 | 4 |
| R12 | Res, Cer, 475Ω, 1%, 1/16W, SM | 410334-064 | 1 |
| R13 | Res, Cer, 499K, 1%, 1/16W, SM | 410334-072 | 1 |
| R14, 15 | Res, Cer, 23.2K, 1%, 1/16W, SM | 410334-069 | 2 |
| R16, 17, 34 | Res, Cer, 301K, 1%, 1/16W, SM | 410334-071 | 3 |
| R18, 19, 56 | Res, Cer, 1K, 1%, 1/16W, SM | 410334-008 | 3 |
| R24 | Res, Cer, 150Ω, 1%, 1/16W, SM | 410334-028 | 1 |
| R25, 29, 42, 61 | Res, Cer, 100Ω, 1%, 1/16W, SM | 410334-003 | 4 |
| R26 | Res, Cer, 16.5K, 1%, 1/16W, SM | 410334-068 | 1 |
| R31 | Res, Cer, 38.3K, 1%, 1/16W, SM | 410334-047 | 1 |
| R33, 35 | Res, Cer, 3.01K, 1%, 1/16W, SM | 410334-018 | 2 |
| R36 | Res, Cer, 2K, 1%, 1/16W, SM | 410334-009 | 1 |
| R37 | Res, Cer, 4.99K, 1%, 1/16W, SM | 410334-066 | 1 |
| R38 | Res, Cer, 200K, 0.1%, 1/8W, SM | 1067-832 | 1 |
| R39 | Res, Cer, 38.8K, 0.1%, 1/8W, SM | 1067-388 | 1 |
| R40 | Res, Cer, 248K, 0.1%, 1/8W, SM | 1067-249 | 1 |
| R41 | Res, Cer, 178K, 0.1%, 1/8W, SM | 1067-849 | 1 |
| R44 | Res, Cer, 11.5K, 1%, 1/16W, SM | 410334-014 | 1 |
| R45, 46 | Res, Cer, 75K, 1%, 1/16W, SM | 410334-063 | 2 |
| R49, 50, 51 | Res, Var, 2K, Side Adjust, SM | 409023-003 | 3 |
| R52 | Res, Cer, 1.5K, 1%, 1/8W, SM | 1082-768 | 1 |
| R58, 66 | Res, Cer, 681Ω, 1%, 1/16W, SM | 410334-065 | 2 |
| R59, 67 | Res, Cer, 8.66K, 1%, 1/16W, SM | 410334-067 | 2 |
| R62 | Res, Cer, 20M, 1%, 1/8W, SM | 1081-510 | 1 |
| R63 | Res, Cer, 332K, 1%, 1/8W, SM | 1082-874 | 1 |
| R64 | Res, Cer, 10M, 5%, 1/8W, SM | 1081-106 | 1 |
| R78, 79 | Res, 340 Ω, 1%, 1/8W, SM | 1082-790 | 2 |
| R80, 81 | Res, Cer, 10K, 1%, 1/8W, SM | 1082-104 | 2 |
| SH1 | Shield, Crystal (For Y1) | 411267-003 | 1 |
| U1 | Volt Rgltr, Adj, SM LP2951A | 3076-001 | 1 |
| U2-4, 7, 8, 10, 11, 13 | Operational Ampl, Dual, SM TLC2272 | 412809-001 | 8 |
| U5 | Operational Ampl, SM TLC2201 | 403385-002 | 1 |
| U6 | Voltage Reference, 2.5V, SM AD680 | 410736-001 | 1 |
| U9 | Res, Ntwk, 10K, 0.1%, SM | 405134-001 | 1 |
| U12 | Analog Switch, SPST, CMOS, Quad DG413 | 408821-001 | 1 |
| U14-16 | DAC, 12-Bit, SM 7543 | 405439-001 | 3 |
| U17 | Data Acquisition, SM LTC1290 | 405948-002 | 1 |
| U18,21, 22 | Res, Ntwk, 100K | 1049-203 | 3 |
| U19 | Inverter, Hex, SM HC04 | 3038-004 | 1 |
| U20 | Counter, Binary, 4-Bit, Dual, SM HC393 | 3038-393 | 1 |
| U23 | EEPROM, Flash Memory, Tram $SpO_2$ | 414474-003 | 1 |

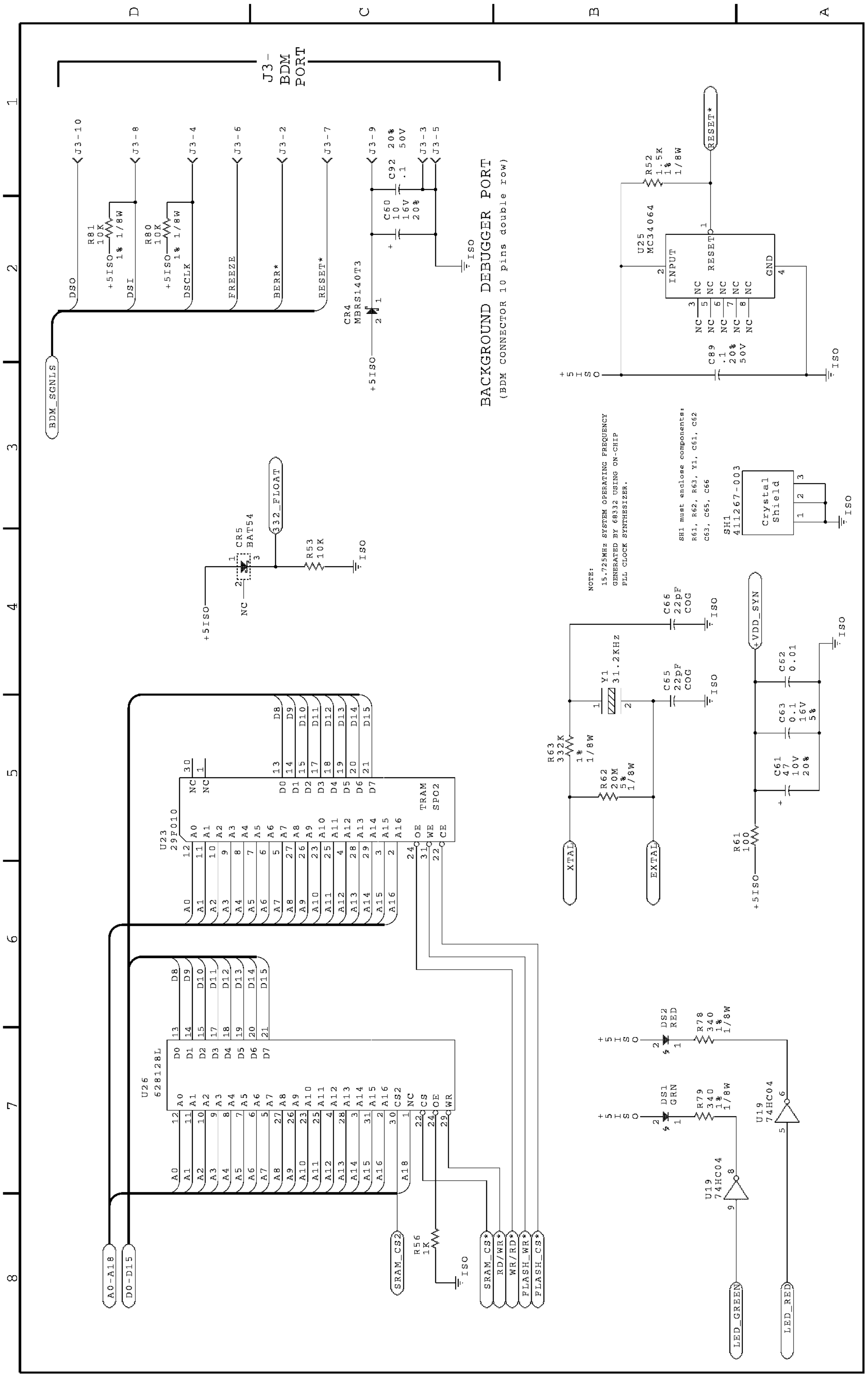
| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| U24 | Microcontroller, 16-MHz, SM 68332 | 408794-001 | 1 |
| U25 | Sensor, Undervoltage, 4.6V, SM MC34064D5 | 408952-001 | 1 |
| U26 | RAM, Static, 128K x 8-Bit, 70nS, SM 628128 | 406255-002 | 1 |
| U27, 28 | Isolator, Optically Coupled, SM 2611 | 408825-001 | 2 |
| U29 | EPROM, Tram $SpO_2$ Communication | 414443-002 | 1 |
| U30 | Programmable Peripheral Interface, PLCC 82C55A | 404697-001 | 1 |
| U31 | Converter, DC-to-DC, Isolated, ±5V | 416151-001 | 1 |
| U32 | Res Ntwk, 100K, SM | 1061-104 | 1 |
| U33 | Diode Pair Array, ESD/Overvoltage Protection, SM | 412586-001 | 1 |
| Y1 | Crystal, 31.2kHz, SM | 408946-001 | 1 |
| Y2 | Crystal Oscillator, 3.6864-MHz, SM | 408828-001 | 1 |
| - | Circuit Board | 800675-003A | 1 |
| - | Schematic Diagram | SD8000674-003A | – |

# Schematic Diagram PN SD800674-003A

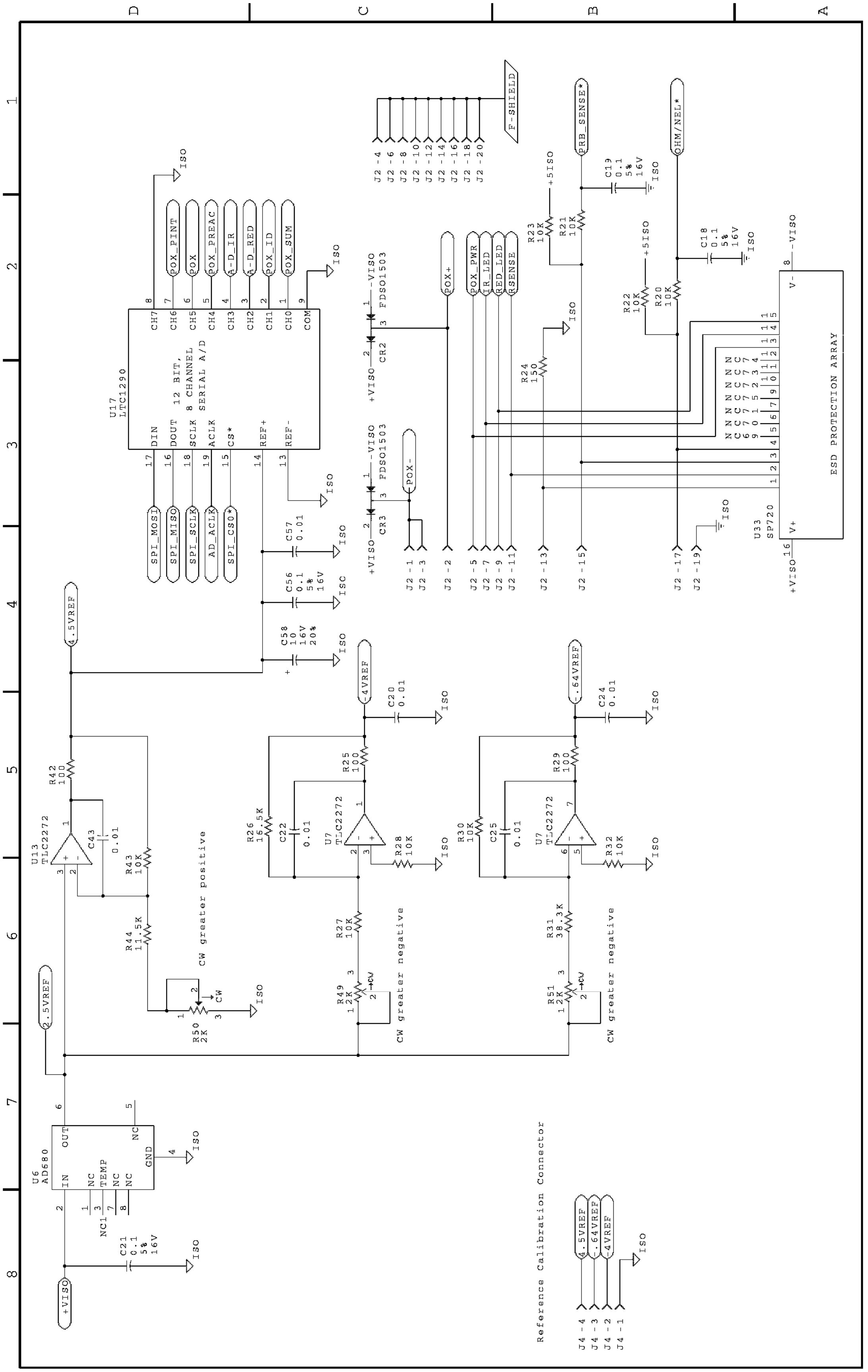
1 of 9


D
C
B
A
1
2
3
4
5
6
7
8
A0-A18
D0-D15
POX_ID1
POX_ID0
LOADDAC*
HALT*
BERR*
POX_CLR*
SRAM_CS2
MODCK
AD_ACLK
BDM_SGNLS
+5ISO
U22
100K
U21
100K
U18
100K
NC4
U20
74HC393
QD
QC
QB
QA
CL
A
NC18
NC9
NC68
ISO
RED_ENBL*
IR_ENBL*
POX_CTRL0
POX_CTRL1
R55
10K
R54
10K
R47
10K
D9
D8
D0
D9 LOW AT RESET ENABLES PORT F
D8 LOW AT RESET ENABLES PORT E
D0 LOW AT RESET == 8 BIT CSBOOT
RD/WR*
WR/RD*
U19
74HC04
Required For Emulator Operation
OHM/NEL*
PRB_SENSE*
RESTORE*
POX_CLR*
LOADDAC*
LED_RED
LED_GREEN
NELLCOR*
NC30
NC14
U24
MC68332
32-BIT INTEGRATED MICROCONTROLLER
132 PIN QFP
A23/CS10*
A22/CS9*
A21/CS8*
A20/CS7*
A19/CS6*
CLKOUT
R/W*
SIZ1/PE.7
SIZ0/PE.6
AS*/PE.5
DS*/PE.4
RMC*/PE.3
AVEC*/PE.2
DSACK1*/PE.1
DSACK0*/PE.0
FC2/CS5*
FC1/CS4*
FC0/CS3*
VSTBY
VDDSYN
XFC
TP15
TP14
TP13
TP12
TP11
TP10
TP9
TP8
TP7
TP6
TP5
TP4
TP3
TP2
TP1
TP0
T2CLK
PCS3*
PCS2*
PCS1*
PCS0*/SS*
MISO
MOSI
SCK
TXD
RXD
FREEZE
DSI
DSO
DSCLK
IRQ7*/PF.7
IRQ6*/PF.6
IRQ5*/PF.5
IRQ4*/PF.4
IRQ3*/PF.3
IRQ2*/PF.2
IRQ1*/PF.1
MODCK/PF.0
BGACK/CS2*
BG/CS1*
BR/CS0*
CSBOOT
HALT*
RESET*
BERR*
TSC
XTAL
EXTAL
NC31
NC32
NC33
NC23
NC22
NC13
NC10
NC67
NC66
NC65
NC64
NC63
NC5
NC24
NC25
NC26
NC27
NC28
NC29
NC8
C64
5%
0.1 16V
+VDD_SYN
NEL_IR*
NEL_RED*
POX_CTRL1
POX_CTRL0
IR_ENBL*
RED_ENBL*
SPI_CS3*
SPI_CS2*
SPI_CS1*
SPI_CS0*
SPI_MISO
SPI_MOSI
SPI_SCLK
TXD_ISO
RXD_ISO
POX_EN*
MODCK
SRAM_CS*
FLASH_WR*
FLASH_CS*
HALT*
RESET*
BERR*
332_FLOAT
XTAL
EXTAL

**2 of 9**


D
C
B
A
1
2
3
4
5
6
7
8
J3- BDM PORT
BACKGROUND DEBUGGER PORT
(BDM CONNECTOR 10 pins double row)
J3-10
J3-8
J3-4
J3-6
J3-2
J3-7
J3-9
J3-3
J3-5
DSO
DSI
DSCLK
FREEZE
BERR*
RESET*
BDM_SGNLS
R81 10K 1% 1/8W
R80 10K 1% 1/8W
+5ISO
C92 .1 20% 50V
C60 10 16V 20%
CR4 MBRS140T3
ISO
U25 MC34064
INPUT
RESET
GND
NC
R52 1.5K 1% 1/8W
RESET*
C89 .1 20% 50V
CR5 BAT54
332_FLOAT
R53 10K
NOTE:
15.725MHz SYSTEM OPERATING FREQUENCY
GENERATED BY 68332 USING ON-CHIP
PLL CLOCK SYNTHESIZER.
SH1 must enclose components:
R61, R62, R63, Y1, C61, C62
C63, C65, C66
SH1 411267-003
Crystal Shield
C66 22pF COG
C65 22pF COG
Y1 31.2KHz
R63 332K 1% 1/8W
R62 20M 5% 1/8W
XTAL
EXTAL
VDD_SYN
C62 0.01
C63 0.1 16V 5%
C61 47 10V 20%
R61 100
U23 29F010
TRAM SPO2
OE
WE
CE
U26 628128L
CS
CS2
WR
A0-A18
D0-D15
SRAM_CS2
R56 1K
SRAM_CS*
RD/WR*
WR/RD*
FLASH_WR*
FLASH_CS*
DS2 RED
DS1 GRN
R78 340 1% 1/8W
R79 340 1% 1/8W
U19 74HC04
LED_GREEN
LED_RED

**3 of 9**


U17
LTC1290
12 BIT,
8 CHANNEL
SERIAL A/D
DIN
DOUT
SCLK
ACLK
CS*
REF+
REF-
CH7
CH6
CH5
CH4
CH3
CH2
CH1
CH0
COM
POX_PINT
POX
POX_PREAC
A-D_IR
A-D_RED
POX_ID
POX_SUM
SPI_MOSI
SPI_MISO
SPI_SCLK
AD_ACLK
SPI_CS0*
ISO
C57
0.01
C56
0.1
5%
16V
C58
10
16V
20%
4.5VREF
+VISO
-VISO
CR2
CR3
FDSO1503
POX+
POX-
POX_PWR
IR_LED
RED_LED
RSENSE
F-SHIELD
PRB_SENSE*
OHM/NEL*
J2-1
J2-2
J2-3
J2-4
J2-5
J2-6
J2-7
J2-8
J2-9
J2-10
J2-11
J2-12
J2-13
J2-14
J2-15
J2-16
J2-17
J2-18
J2-19
J2-20
+5ISO
R23
10K
R21
10K
C19
0.1
5%
16V
R22
10K
R20
10K
C18
0.1
5%
16V
R24
150
U33
SP720
ESD PROTECTION ARRAY
V+
V-
NC
.4VREF
C20
0.01
R25
100
R26
16.5K
C22
0.01
U7
TLC2272
R28
10K
R27
10K
R49
1.2K
CW greater negative
.64VREF
C24
0.01
R29
100
R30
10K
C25
0.01
R32
10K
R31
38.3K
R51
1.2K
R42
100
U13
TLC2272
C43
0.01
R43
10K
R44
11.5K
CW greater positive
R50
2K
CW
2.5VREF
U6
AD680
IN
NC
TEMP
GND
OUT
NC1
C21
0.1
5%
16V
Reference Calibration Connector
J4-1
J4-2
J4-3
J4-4
A
B
C
D
1
2
3
4
5
6
7
8

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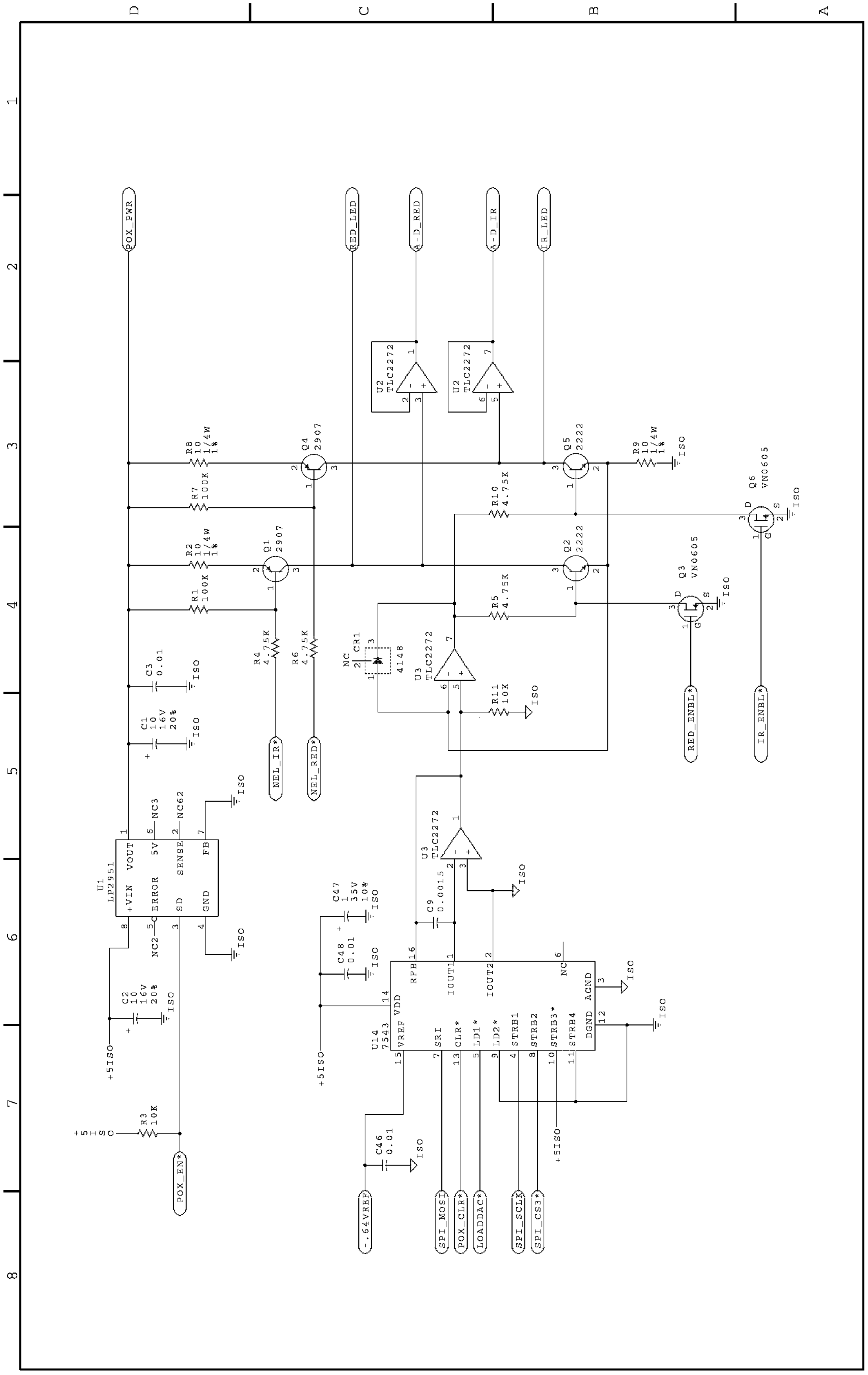
D
C
B
A
1
2
3
4
5
6
7
8
POX_PWR
RED_LED
A-D_RED
A-D_IR
IR_LED
U2 TLC2272
U2 TLC2272
R8 10 1/4W 1%
Q4 2907
Q5 2222
R9 10 1/4W 1%
ISO
R7 100K
R10 4.75K
Q6 VN0605
R2 10 1/4W 1%
Q1 2907
Q2 2222
R1 100K
R5 4.75K
Q3 VN0605
ISC
R4 4.75K
R6 4.75K
NC
CR1 4148
U3 TLC2272
R11 10K
C3 0.01
C1 10 16V 20%
NEL_IR*
NEL_RED*
RED_ENBL*
IR_ENBL*
U1 LP2951
+VIN
VOUT
5V
SENSE
FB
ERROR
SD
GND
NC3
NC62
NC2
U3 TLC2272
C47 1 35V 10%
C9 0.0015
C48 0.01
U14 7543
VREF
VDD
RFB
IOUT1
IOUT2
NC
AGND
DGND
SRI
CLR*
LD1*
LD2*
STRB1
STRB2
STRB3*
STRB4
C2 10 16V 20%
+5ISO
R3 10K
POX_EN*
C46 0.01
-.64VREF
SPI_MOSI
POX_CLR*
LOADDAC*
SPI_SCLK
SPI_CS3*

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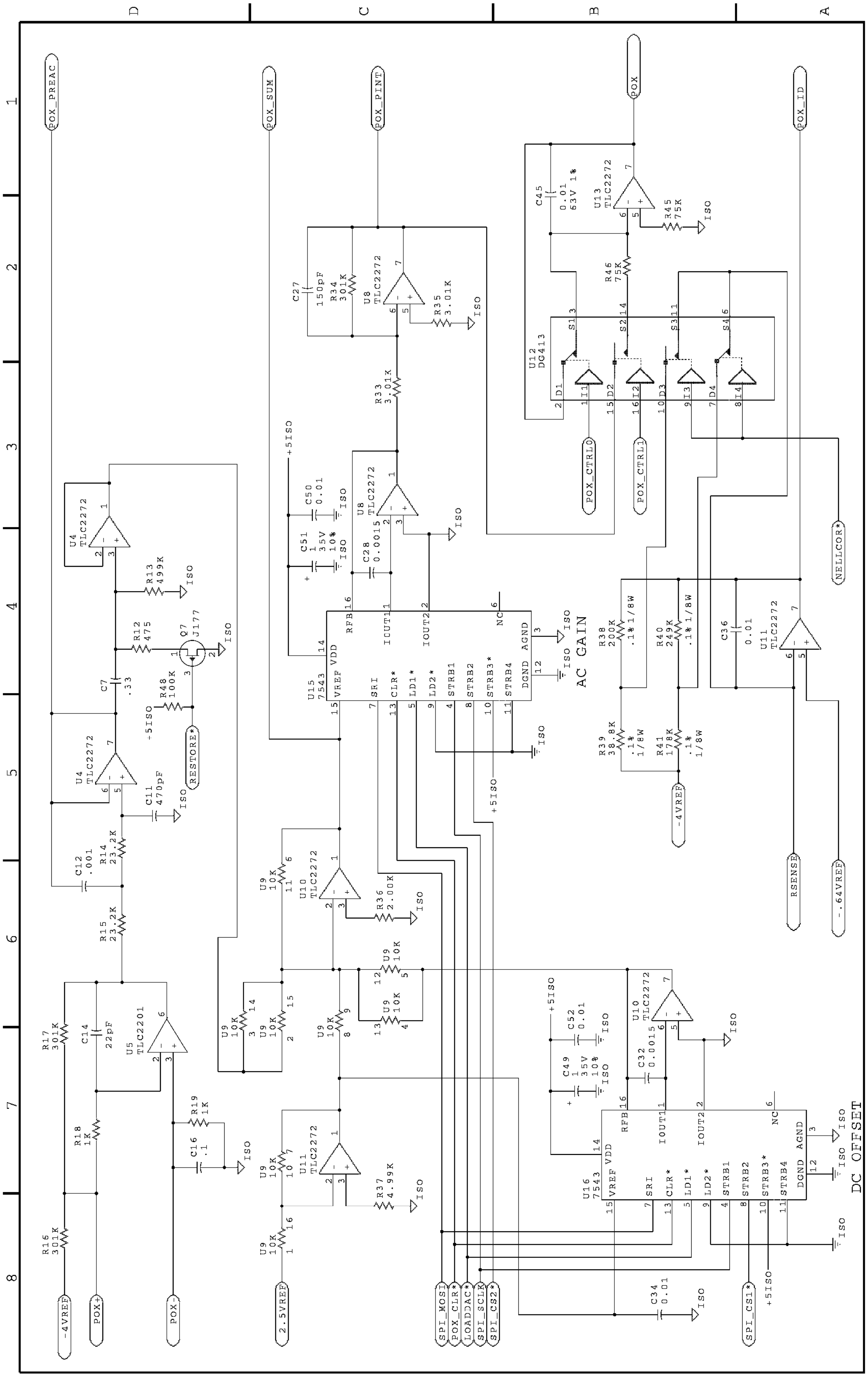
D
C
B
A
1
2
3
4
5
6
7
8
POX_PREAC
POX_SUM
POX_PINT
POX
POX_ID
C27 150pF
R34 301K
U8 TLC2272
R35 3.01K
ISO
C45 0.01 63V 1%
U13 TLC2272
R45 75K
R46 75K
U12 DG413
S1 S2 S3 S4
D1 D2 D3 D4
I1 I2 I3 I4
R33 3.01K
+5ISO
C50 0.01
C51 1 35V 10%
C28 0.0015
POX_CTRL0
POX_CTRL1
NELLCOR*
U4 TLC2272
R13 499K
R12 475
Q7 J177
C7 .33
R48 100K
-5ISO
RESTORE*
U15 7543
VREF VDD RFB IOUT1 IOUT2 NC AGND DGND SRI CLR* LD1* LD2* STRB1 STRB2 STRB3* STRB4
AC GAIN
R38 200K .1% 1/8W
R40 249K .1% 1/8W
C36 0.01
U11 TLC2272
R39 38.8K .1% 1/8W
R41 178K .1% 1/8W
-4VREF
C11 470pF
C12 .001
R14 23.2K
R15 23.2K
U9 10K
U10 TLC2272
R36 2.00K
RSENSE
-.64VREF
R17 301K
C14 22pF
U5 TLC2201
R18 1K
R19 1K
C16 .1
U11 TLC2272
R37 4.99K
R16 301K
C52 0.01
C49 1 35V 10%
C32 0.0015
U10 TLC2272
U16 7543
DC OFFSET
C34 0.01
POX+
POX-
2.5VREF
SPI_MOSI
POX_CLR*
LOADDAC*
SPI_SCLK
SPI_CS2*
SPI_CS1*

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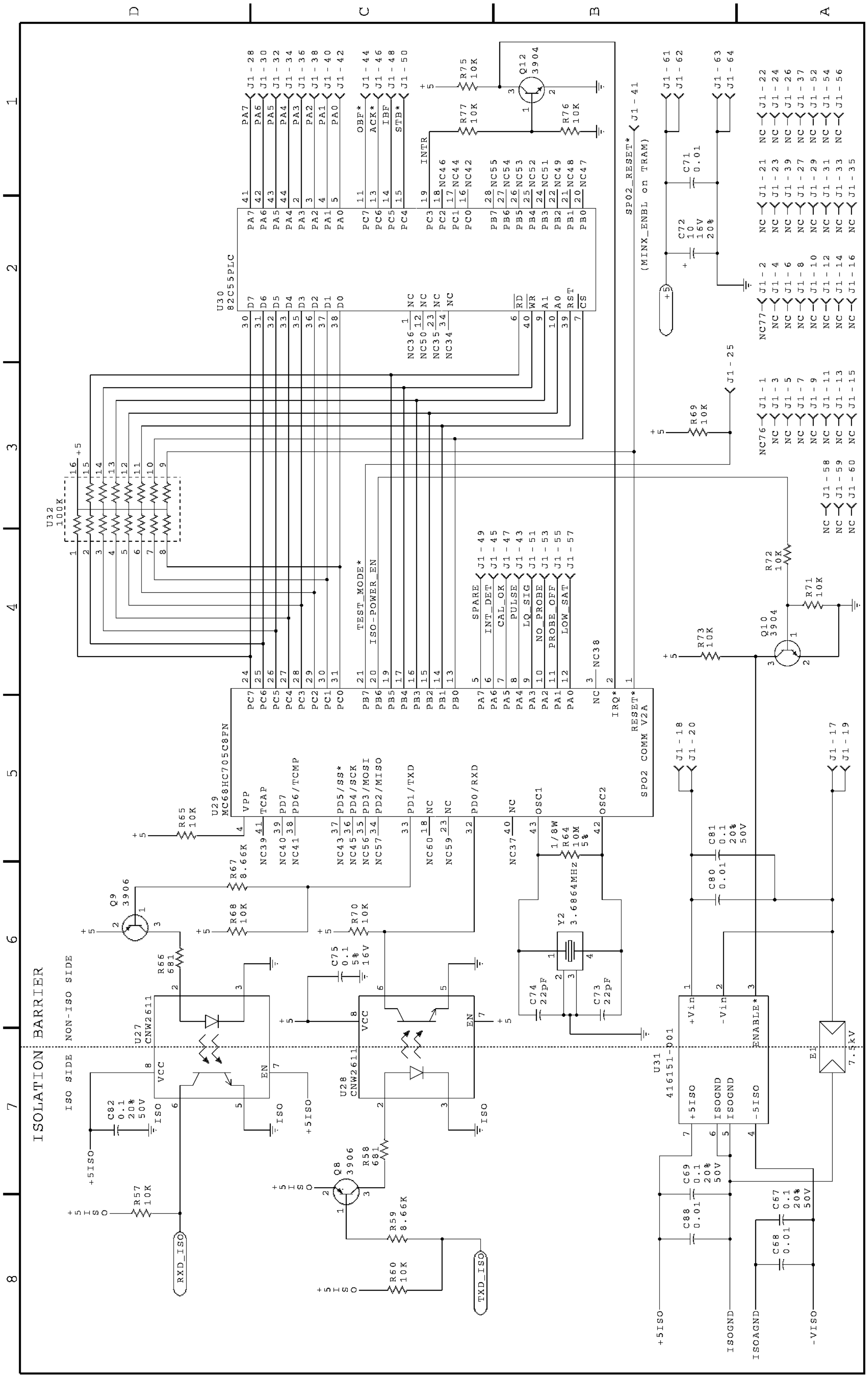
U30
82C55PLC
U29
MC68HC705C8FN
SPO2 COMM V2A
U32
100K
U27
CNW2611
U28
CNW2611
U31
416151-001
Q9
3906
Q8
3906
Q10
3904
Q12
3904
Y2
3.6864MHz
E1
7.5kV
ISOLATION BARRIER
ISO SIDE
NON-ISO SIDE
RXD_ISO
TXD_ISO
+5ISO
ISOGND
ISOAGND
-VISO
SPO2_RESET*
(MINX_ENBL on TRAM)
TEST_MODE*
ISO-POWER_EN
SPARE
INT_DET
CAL_OK
PULSE
LQ_SIG
NO_PROBE
PROBE_OFF
LOW_SAT
INTR
OBF*
ACK*
IBF
STB*
R64
10M
5%
1/8W
C74
22pF
C73
22pF
C75
0.1
5%
16V
C72
10
16V
20%
C71
0.01
C81
0.1
20%
50V
C80
0.01
C82
0.1
20%
50V
C69
0.1
20%
50V
C88
0.01
C67
0.1
20%
50V
C68
0.01
R65
10K
R67
8.66K
R68
10K
R66
681
R70
10K
R57
10K
R58
681
R59
8.66K
R60
10K
R69
10K
R72
10K
R71
10K
R73
10K
R75
10K
R77
10K
R76
10K
D
C
B
A
1
2
3
4
5
6
7
8

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| IC POWER/RETURN CHART | | | | | | POWER SUPPLY BYPASS | | | |
|---|---|---|---|---|---|---|---|---|---|
| IC | | POWER | | RETURN | | REFD | VALUE | PWR | RTN |
| U29 | 68HC705 | 44 | | 22 | | C79 | 0.1 | +5 | GND |
| U30 | 82C55PLC | 29 | | 8 | | C76 | 0.1 | +5 | GND |

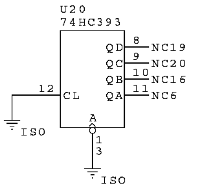
ISOLATION BARRIER

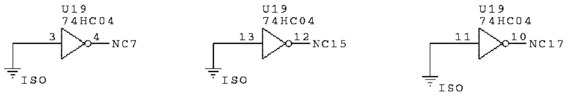
Non-iso Side

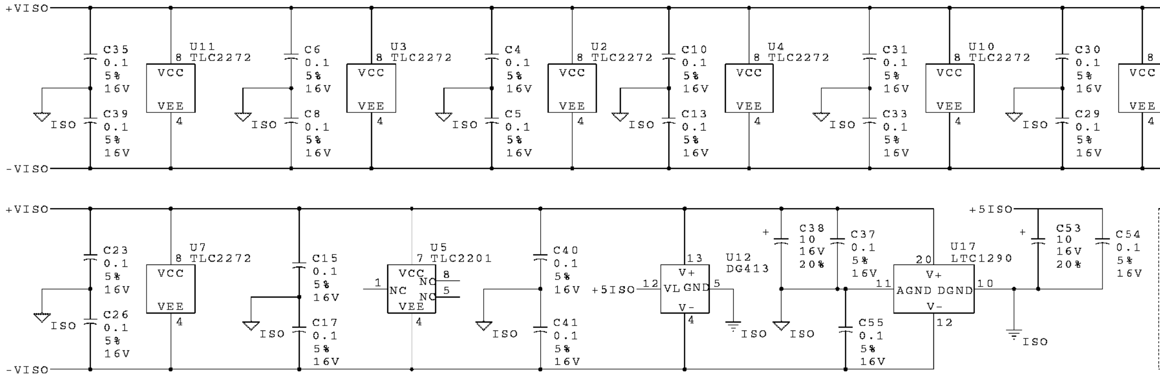
Iso Side

| IC POWER/RETURN CHART | | | | | | POWER SUPPLY BYPASS | | | | POWER SUPPLY BYPASS | | | | POWER SUPPLY BYPASS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IC | | POWER | | RETURN | | REFD | VALUE | PWR | RTN | REFD | VALUE | PWR | RTN | REFD | VALUE | PWR | RTN |
| U24 | MC68332 | 1,7,18,28,39,<br>50,63,65,84,<br>96,107,116,126 | | 2,8,17,29,40,51<br>59,67,83,95,101<br>106,117,127,34 | | C59 | 10* | +5ISO | ISOGND | C86 | .1 | +5ISO | ISOGND | C101 | .1 | +5ISO | ISOGND |
| | | | | | | C95 | .1 | +5ISO | ISOGND | C91 | .1 | +5ISO | ISOGND | C102 | .1 | +5ISO | ISOGND |
| | | | | | | C96 | .1 | +5ISO | ISOGND | C100 | .1 | +5ISO | ISOGND | | | | |
| | | | | | | C87 | .1 | +5ISO | ISOGND | C90 | .1 | +5ISO | ISOGND | | | | |
| | | | | | | C85 | .1 | +5ISO | ISOGND | C99 | .1 | +5ISO | ISOGND | | | | |
| | | | | | | C98 | .1 | +5ISO | ISOGND | C97 | .1 | +5ISO | ISOGND | | | | |
| U19 | 74HC04 | 14 | | 7 | | C93 | .1 | +5ISO | ISOGND | | | | | | | | |
| U26 | 628128L | 32 | | 16 | | C83 | .1 | +5ISO | ISOGND | | | | | | | | |
| U23 | 29F010-70 | 32 | | 16 | | C84 | .1 | +5ISO | ISOGND | | | | | | | | |
| U20 | 74HC393 | 14 | | 7 | | C94 | .1 | +5ISO | ISOGND | | | | | | | | |

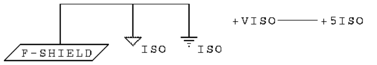
* 16V,20%


U20
74HC393
12
CL
QD 8 NC19
QC 9 NC20
QB 10 NC16
QA 11 NC6
A
1
3
ISO
ISO


U19
74HC04
3
4
NC7
ISO
U19
74HC04
13
12
NC15
ISO
U19
74HC04
11
10
NC17
ISO


+VISO
-VISO
C35 0.1 5% 16V
C39 0.1 5% 16V
U11 TLC2272
C6 0.1 5% 16V
C8 0.1 5% 16V
U3 TLC2272
C4 0.1 5% 16V
C5 0.1 5% 16V
U2 TLC2272
C10 0.1 5% 16V
C13 0.1 5% 16V
U4 TLC2272
C31 0.1 5% 16V
C33 0.1 5% 16V
U10 TLC2272
C30 0.1 5% 16V
C29 0.1 5% 16V
U8 TLC2272
C42 0.1 5% 16V
C44 0.1 5% 16V
U13 TLC2272
VCC
VEE
8
4
ISO
+VISO
-VISO
C23 0.1 5% 16V
C26 0.1 5% 16V
U7 TLC2272
C15 0.1 5% 16V
C17 0.1 5% 16V
U5 TLC2201
NC
1
7
8
5
C40 0.1 5% 16V
C41 0.1 5% 16V
+5ISO
U12 DG413
V+
VL
GND
V-
13
12
5
4
C38 10 16V 20%
C37 0.1 5% 16V
C55 0.1 5% 16V
U17 LTC1290
V+
AGND
DGND
V-
20
11
10
12
+5ISO
C53 10 16V 20%
C54 0.1 5% 16V
+
ISO

NOTE: Tie ISOAGND, ISOGND and FSHIELD planes together at pins 13 and 14 of U303. Tie +VISO plane to +5ISO plane near ISOAGND, FSHIELD and ISOGND connection.


F-SHIELD
ISO
ISO
+VISO
+5ISO

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| LABEL | PAGE COORDINATES |
|---|---|
| +5: | 6-B2,B3,B4,B6,C1,C6,D3,D5,D6 |
| +5ISO: | 1-C7,D2,D7<br>2-A6,B3,B7,C3,D2,D4<br>3-B1,B2<br>4-B7,C7,D7<br>5-A8,B6,C3,C5,D5<br>6-B8,C7,C8,D7,D8<br>7-A1,A5,B3 |
| +VDD_SYN: | 1-D8<br>2-A4 |
| +VISO: | 3-A4,C3,C4,D8<br>7-A1,B8 |
| -.64VREF: | 3-B5,B8<br>4-C8<br>5-A6 |
| -4VREF: | 3-B8,C5<br>5-B5,D8 |
| -VISO: | 3-A2,C2,C3<br>6-A8<br>7-A8,B8 |
| 2.5VREF: | 3-D7<br>5-C8 |
| 332_FLOAT: | 1-A8<br>2-C4 |
| 4.5VREF: | 3-B8,D4 |
| A-D_IR: | 3-D2<br>4-C2 |
| A-D_RED: | 3-D2<br>4-C2 |
| A0: | 1-C3,C5<br>2-D6,D7 |
| A1: | 1-C3,C5<br>2-D6,D7 |
| A2: | 1-C3,C5<br>2-D6,D7 |
| A3: | 1-C3,C5<br>2-D6,D7 |
| A4: | 1-C3,C5<br>2-D6,D7 |
| A5: | 1-C3,C5<br>2-D6,D7 |
| A6: | 1-C3,C5<br>2-C6,D7 |
| A7: | 1-C3,C5<br>2-C6,C7 |
| A8: | 1-C3,C5<br>2-C6,C7 |
| A9: | 1-C3,C5<br>2-C6,C7 |

| LABEL | PAGE COORDINATES |
|---|---|
| A10: | 1-C3,D5<br>2-C6,C7 |
| A11: | 1-C3,D5<br>2-C6,C7 |
| A12: | 1-C2,D5<br>2-C6,C7 |
| A13: | 1-C2,D5<br>2-C6,C7 |
| A14: | 1-C2,D5<br>2-C6,C7 |
| A15: | 1-C2,D5<br>2-C6,C7 |
| A16: | 1-C2,D5<br>2-C6,C7 |
| A17: | 1-C2,D5 |
| A18: | 1-C2,D5<br>2-C7 |
| ACK*: | 6-C1 |
| AD_ACLK: | 1-B2<br>3-D4 |
| BERR*: | 1-A8,B2<br>2-C2 |
| CAL_OK: | 6-B4 |
| D0: | 1-B5,C4 |
| D1: | 1-B5,D2 |
| D2: | 1-B5,D2 |
| D3: | 1-B5,D2 |
| D4: | 1-B5,D2 |
| D5: | 1-B5,D2 |
| D6: | 1-B5,D3 |
| D7: | 1-B5,D3 |
| D8: | 1-C5,D4<br>2-C5,D6 |
| D9: | 1-C5,D4<br>2-C5,D6 |
| D10: | 1-C5,D3<br>2-C5,D6 |
| D11: | 1-C5,D3<br>2-C5,D6 |
| D12: | 1-C5,D3<br>2-C5,D6 |
| D13: | 1-C5,D3<br>2-C5,D6 |
| D14: | 1-C5,D3<br>2-C5,D6 |
| D15: | 1-C5,D3<br>2-C5,C6 |

| LABEL | PAGE COORDINATES |
|---|---|
| DSCLK: | 1-B7<br>2-D2 |
| DSI: | 1-B7<br>2-D2 |
| DSO: | 1-B7<br>2-D2 |
| EXTAL: | 1-A8<br>2-B6 |
| FLASH_CS*: | 1-B8<br>2-B8 |
| FLASH_WR*: | 1-B8<br>2-B8 |
| FREEZE: | 1-C7<br>2-D2 |
| HALT*: | 1-B8,C2 |
| IBF: | 6-C1 |
| INTR: | 6-C1 |
| INT_DET: | 6-C4 |
| IR_ENBL*: | 1-B3,C8<br>4-A5 |
| IR_LED: | 3-C2<br>4-B2 |
| ISO-POWER_EN: | 6-C4 |
| ISOAGND: | 6-A8 |
| ISOGND: | 6-B8 |
| LED_GREEN: | 1-D5<br>2-B8 |
| LED_RED: | 1-D5<br>2-A8 |
| LOADDAC*: | 1-A5,C2<br>4-C8<br>5-C8 |
| LOW_SAT: | 6-B4 |
| LQ_SIG: | 6-B4 |
| MODCK: | 1-B2,B8 |
| NELLCOR*: | 1-D5<br>5-A4 |
| NEL_IR*: | 1-C8<br>4-C5 |
| NEL_RED*: | 1-C8<br>4-C5 |
| NO_PROBE: | 6-B4 |
| OBF*: | 6-C1 |
| OHM/NEL*: | 1-B5<br>3-B1 |

| LABEL | PAGE COORDINATES |
|---|---|
| PA0: | 6-C1 |
| PA1: | 6-C1 |
| PA2: | 6-C1 |
| PA3: | 6-C1 |
| PA4: | 6-C1 |
| PA5: | 6-C1 |
| PA6: | 6-C1 |
| PA7: | 6-D1 |
| POX: | 3-D2<br>5-B1 |
| POX+: | 3-C2<br>5-D8 |
| POX-: | 3-C3<br>5-D8 |
| POX_CLR*: | 1-A5,B2<br>4-C8<br>5-C8 |
| POX_CTRL0: | 1-B4,C8<br>5-B3 |
| POX_CTRL1: | 1-B4,C8<br>5-B3 |
| POX_EN*: | 1-B8<br>4-D8 |
| POX_ID: | 3-C2<br>5-A1 |
| POX_ID0: | 1-D1,D8 |
| POX_ID1: | 1-D1,D8 |
| POX_PINT: | 3-D2<br>5-C1 |
| POX_PREAC: | 3-D2<br>5-D1 |
| POX_PWR: | 3-C2<br>4-D2 |
| POX_SUM: | 3-C2<br>5-C1 |
| PRB_SENSE*: | 1-B5<br>3-B1 |
| PROBE_OFF: | 6-B4 |
| PULSE: | 6-B4 |
| RD/WR*: | 1-B4<br>2-B8 |
| RED_ENBL*: | 1-B4,C8<br>4-B5 |
| RED_LED: | 3-B2<br>4-C2 |

9 of 9

| LABEL | PAGE COORDINATES |
|---|---|
| RESET*: | 1-B8<br>2-B1,C2 |
| RESTORE*: | 1-A5<br>5-D5 |
| RSENSE: | 3-B2<br>5-A6 |
| RXD_ISO: | 1-C8<br>6-D8 |
| SP02_RESET*: | 6-B2 |
| SPARE: | 6-C4 |
| SPI_CS0*: | 1-C8<br>3-D4 |
| SPI_CS1*: | 1-C8<br>5-A8 |
| SPI_CS2*: | 1-C8<br>5-C8 |
| SPI_CS3*: | 1-C8<br>4-B8 |
| SPI_MISO: | 1-C8<br>3-D4 |
| SPI_MOSI: | 1-C8<br>3-D4<br>4-C8<br>5-C8 |
| SPI_SCLK: | 1-C8<br>3-D4<br>4-B8<br>5-C8 |
| SRAM_CS*: | 1-B8<br>2-C8 |
| SRAM_CS2: | 1-B2<br>2-C8 |
| STB*: | 6-C1 |
| TEST_MODE*: | 6-C4 |
| TXD_ISO: | 1-C8<br>6-C8 |
| WR/RD*: | 1-A4<br>2-B8 |
| XTAL: | 1-A8<br>2-B6 |

| REFDES | PAGE COORDINATES |
|---|---|
| U1: | 4-D6 |
| U2: | 4-C3<br>7-B5 |
| U3: | 4-C5,C6<br>7-B6 |
| U4: | 5-D4,D5<br>7-B4 |
| U5: | 5-D7<br>7-B6 |
| U6: | 3-D8 |
| U7: | 3-B6,C6<br>7-B7 |
| U8: | 5-C2,C4<br>7-B3 |
| U9: | 5-C6,C7,C8,D7 |
| U10: | 5-B7,C6<br>7-B4 |
| U11: | 5-A4,C7<br>7-B7 |
| U12: | 5-B3<br>7-B5 |
| U13: | 3-D6<br>5-B2<br>7-B2 |
| U14: | 4-C7 |
| U15: | 5-C5 |
| U16: | 5-B8 |
| U17: | 3-D3<br>7-B4 |
| U18: | 1-C3 |
| U19: | 1-A4<br>2-A7,B8<br>7-C5,C6,C7,C8 |
| U20: | 1-B3<br>7-C3,C8 |
| U21: | 1-C3 |
| U22: | 1-D3 |
| U23: | 2-D5<br>7-C8 |
| U24: | 1-D7<br>7-C8 |
| U25: | 2-B2 |
| U26: | 2-D7<br>7-C8 |
| U27: | 6-D7 |
| U28: | 6-C7 |

| REFDES | PAGE COORDINATES |
|---|---|
| U29: | 6-D5<br>7-D8 |
| U30: | 6-D2<br>7-D8 |
| U31: | 6-B7 |
| U32: | 6-D4 |
| U33: | 3-A4 |

| CONNECTOR | SIGNAL |
|---|---|
| J1-17: | 06030065 |
| J1-18: | 06054054 |
| J1-19: | 06030065 |
| J1-20: | 06054054 |
| J1-25: | TEST_MODE* |
| J1-28: | PA7 |
| J1-30: | PA6 |
| J1-32: | PA5 |
| J1-34: | PA4 |
| J1-36: | PA3 |
| J1-38: | PA2 |
| J1-40: | PA1 |
| J1-41: | SP02_RESET* |
| J1-42: | PA0 |
| J1-43: | PULSE |
| J1-44: | OBF* |
| J1-45: | INT_DET |
| J1-46: | ACK* |
| J1-47: | CAL_OK |
| J1-48: | IBF |
| J1-49: | SPARE |
| J1-50: | STB* |
| J1-51: | LQ_SIG |
| J1-53: | NO_PROBE |
| J1-55: | PROBE_OFF |
| J1-57: | LOW_SAT |
| J1-61: | +5 |
| J1-62: | +5 |
| J1-63: | GND |
| J1-64: | GND |

| CONNECTOR | SIGNAL |
|---|---|
| J2-1: | POX- |
| J2-2: | POX+ |
| J2-3: | POX- |
| J2-4: | FSHIELD |
| J2-5: | POX_PWR |
| J2-6: | FSHIELD |
| J2-7: | IR_LED |
| J2-8: | FSHIELD |
| J2-9: | RED_LED |
| J2-10: | FSHIELD |
| J2-11: | RSENSE |
| J2-12: | FSHIELD |
| J2-13: | 03067043 |
| J2-14: | FSHIELD |
| J2-15: | 03067046 |
| J2-16: | FSHIELD |
| J2-17: | 03067053 |
| J2-18: | FSHIELD |
| J2-19: | ISOGND |
| J2-20: | FSHIELD |
| J3-2: | BERR* |
| J3-3: | ISOGND |
| J3-4: | DSCLK |
| J3-5: | ISOGND |
| J3-6: | FREEZE |
| J3-7: | RESET* |
| J3-8: | DSI |
| J3-9: | 02086029 |
| J3-10: | DSO |
| J4-1: | ISOAGND |
| J4-2: | -4VREF |
| J4-3: | -.64VREF |
| J4-4: | 4.5VREF |

# Assembly Revisions PN 800674

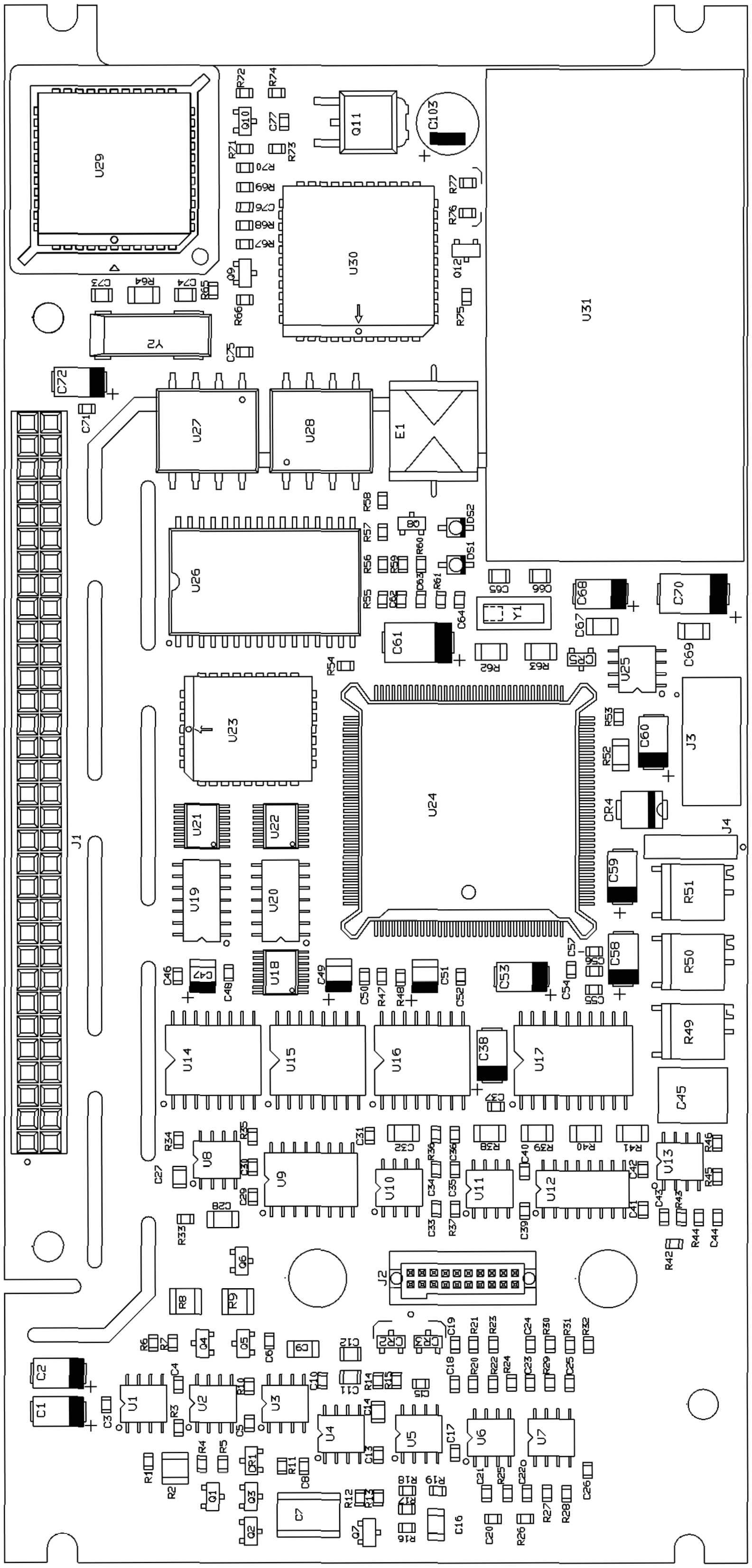
The current baseline revision for this assembly is pn 800674-003A. Earlier versions of this assembly are presented later in this chapter. To convert the parts list, pn 800674-001A/002B, back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

**PN 800674-001A**

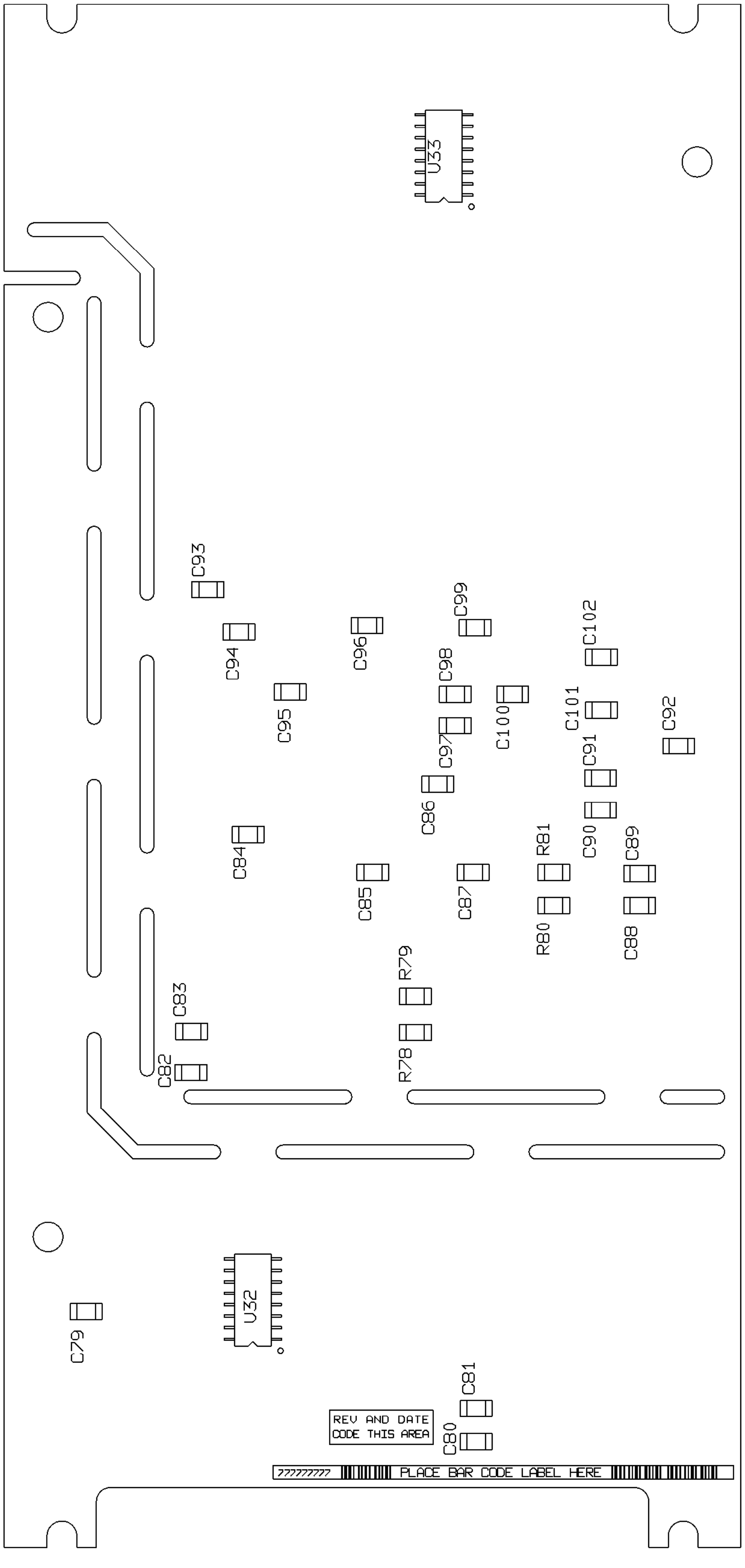
| Reference Designation | Description | Revision's Part Number | Baseline Part Number | Qty |
|---|---|---|---|---|
| U23 | EEPROM, Flash Memory, Tram $SpO_2$ | 414474-001 | 414474-003 | 1 |
| Use SD800674-002 schematic diagram except for U29 and Y2 are different as noted in this parts list.) | | | | |

# Parts Location Diagram PN 800674-001A/002B

1 of 2


R72
R74
Q10
C77
R71
R73
R70
R69
C76
R68
R67
Q9
R66
C75
U29
C73
R64
C74
R65
Q11
C103
R77
R76
Q12
R75
U30
U31
Y2
C72
C71
U27
U28
E1
R58
Q8
DS2
R57
R60
DS1
R56
R59
C63
R55
C62
R61
C64
U26
C65
C66
C68
C70
Y1
C67
C61
R54
R62
R63
CR5
U25
C69
U23
U24
R53
R52
C60
J3
CR4
J4
J1
U21
U22
U19
U20
C59
R51
C58
R50
C57
C56
C55
C54
C53
U18
C46
C47
C48
C49
C50
R47
R48
C51
C52
U14
U15
U16
C38
U17
C37
R49
C45
R34
R35
C27
U8
C30
C29
U9
C31
C32
R36
C36
C34
C35
U10
U11
R38
R39
C40
R40
R41
U12
C42
U13
R46
R45
C43
R43
C41
C33
R37
C39
R44
C44
R42
R33
C28
Q6
J2
R8
R9
R6
R7
Q4
Q5
C6
C9
C12
CR2
CR3
C19
R21
R23
C24
R30
R31
R32
C18
R20
R22
R24
C23
R29
C25
C2
C1
U1
U2
U3
C4
C3
R3
R10
C5
C10
C11
R14
R15
C15
C14
U4
U5
C17
U6
U7
C13
R4
R5
CR1
R1
R2
R11
C8
Q1
Q3
Q2
C7
R12
R13
R17
R18
R19
Q7
R16
C16
C21
R25
C22
C20
R26
R27
R28
C26

2 of 2


U33
C93
C94
C96
C99
C102
C95
C98
C100
C101
C92
C97
C91
C86
C84
R81
C90
C89
C85
C87
R80
C88
R79
C83
C82
R78
U32
C79
C81
C80
REV AND DATE CODE THIS AREA
??????? PLACE BAR CODE LABEL HERE

# Parts List PN 800674-001A/002B

| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| C1, 2, 38, 53, 58-60, 68, 72 | Cap, Tant, 10µF, 20%, 16V, SM | 1176-106 | 9 |
| C3, 20, 22, 24, 25, 34, 36, 43, 46, 48, 50, 52, 57, 62, 71, 77 | Cap, Cer, 0.1µF, 5%, 50V | 411575-012 | 16 |
| C4-6, 8, 10, 13, 15, 17-19, 21, 23, 26, 29-31, 33, 35, 37, 39, 40-42, 44, 54-56, 63, 64, 75, 76 | Cap, Cer, 0.1µF, 5%, 16V | 411575-002 | 31 |
| C7 | Cap, Cer, 0.33µF, 5%, 50V | 1181-334 | 1 |
| C9, 28, 32 | Cap, Cer, 0.0015µF, 5%, SM | 1181-152 | 3 |
| C11 | Cap, Cer, 470pF, 5%, 50V, SM | 1181-471 | 1 |
| C12 | Cap, Cer, 0.001µF, 5%, 50V, SM | 1181-102 | 1 |
| C14, 65, 66, 73, 74 | Cap, Cer, 22pF, 5%, 50V, SM | 1181-220 | 5 |
| C16 | Cap, Cer, 0.1µF, 5%, 50V, SM | 1182-104 | 1 |
| C27 | Cap, Cer, 150pF, 5%, 50V, SM | 1181-151 | 1 |
| C45 | Cap, PP, 0.01µF, 1%, 63V | 408822-001 | 1 |
| C47, 49, 51 | Cap, Tant, 1.0µF, 10%, 35V, SM | 403907-001 | 3 |
| C61 | Cap, Tant, 47µF, 20%, 10V, SM | 405585-001 | 1 |
| C70 | Cap, Tant, 22µF, 10%, 25V, SM | 407653-001 | 1 |
| C67, 69, 79, 81-87, 89-102 | Cap, Cer, 0.1µF, 20%, 50V | 404370-001 | 24 |
| C80, 88 | Cap, Cer, 0.01µF, 5%, 50V, SM | 400265-001 | 2 |
| C103 | Cap, Al, 100µF, 20%, 25V | 401722-001 | 1 |
| CR1 | Diode, SM MMAD4148 | 401980-001 | 1 |
| CR2, 3 | Diode, SM FDSO1503 | 2414-001 | 2 |
| CR4 | Diode, Schottky, Barrier, 1A, 40V, SM MBRS140T3 | 403187-001 | 1 |
| CR5 | Diode, Schottky, SM BAT54 | 401985-001 | 1 |
| DS1 | Diode, Light-Emitting (Green) | 401429-003 | 1 |
| DS2 | Diode, Light-Emitting (Red) | 401429-001 | 1 |
| E1 | Surge Protector, 7.5kV, ±15% | 1931-001 | 1 |
| J1 | Connector, PC Header, 64-Pin | 1847-064 | 1 |
| J2 | Connector, PC Header, 20-Pin, SM | 413053-002 | 1 |
| J3 | PC Post, 2 x 5-Pin | 413864-001 | 1 |
| J4 | PC Post, 1 x 4-Pin | 413864-002 | 1 |
| Q1, 4 | Transistor, PNP, SM T2907A | 405759-001 | 2 |
| Q2, 5 | Transistor, NPN, SM MMBT222 | 404927-001 | 2 |
| Q3, 6 | Transistor, MOSFET, N-Channel, Enhancement Mode, SM VN0605T | 406267-001 | 2 |
| Q7 | Transistor, JFET, P-Channel, SM MMBFJ117 | 404417-001 | 1 |
| Q8, 9 | Transistor, PNP, SM T3906 | 2511-101 | 2 |
| Q10, 12 | Transistor, NPN, SM T3904 | 2511-001 | 2 |

| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| Q11 | Transistor, HEXFET, P-Channel, 25W, SM IRFR9010TR | 406513-001 | 1 |
| R1, 7, 48 | Res, Cer, 100K, 1%, 1/16W, SM | 410334-019 | 3 |
| R2, 8, 9 | Res, Cer, 10.0K, 1%, 1/4W | 407468-002 | 3 |
| R3, 11, 20-23, 27, 28, 30, 32, 43, 47, 53-55, 57, 60, 65, 68-77 | Res, Cer, 10K, 1%, 1/16W, SM | 410334-013 | 28 |
| R4-6, 10 | Res, Cer, 4.75K, 1%, 1/16W, SM | 410334-010 | 4 |
| R12 | Res, Cer, 475Ω, 1%, 1/16W, SM | 410334-064 | 1 |
| R13 | Res, Cer, 499K, 1%, 1/16W, SM | 410334-072 | 1 |
| R14, 15 | Res, Cer, 23.2K, 1%, 1/16W, SM | 410334-069 | 2 |
| R16, 17, 34 | Res, Cer, 301K, 1%, 1/16W, SM | 410334-071 | 3 |
| R18, 19, 56 | Res, Cer, 1K, 1%, 1/16W, SM | 410334-008 | 3 |
| R24 | Res, Cer, 150Ω, 1%, 1/16W, SM | 410334-028 | 1 |
| R25, 29, 42, 61 | Res, Cer, 100Ω, 1%, 1/16W, SM | 410334-003 | 4 |
| R26 | Res, Cer, 16.5K, 1%, 1/16W, SM | 410334-068 | 1 |
| R31 | Res, Cer, 38.3K, 1%, 1/16W, SM | 410334-047 | 1 |
| R33, 35 | Res, Cer, 3.01K, 1%, 1/16W, SM | 410334-018 | 2 |
| R36 | Res, Cer, 2K, 1%, 1/16W, SM | 410334-009 | 1 |
| R37 | Res, Cer, 4.99K, 1%, 1/16W, SM | 410334-066 | 1 |
| R38 | Res, Cer, 200K, 0.1%, 1/8W, SM | 1067-832 | 1 |
| R39 | Res, Cer, 38.8K, 0.1%, 1/8W, SM | 1067-388 | 1 |
| R40 | Res, Cer, 248K, 0.1%, 1/8W, SM | 1067-249 | 1 |
| R41 | Res, Cer, 178K, 0.1%, 1/8W, SM | 1067-849 | 1 |
| R44 | Res, Cer, 11.5K, 1%, 1/16W, SM | 410334-014 | 1 |
| R45, 46 | Res, Cer, 75K, 1%, 1/16W, SM | 410334-063 | 2 |
| R49, 50, 51 | Res, Var, 2K, Side Adjust, SM | 409023-003 | 3 |
| R52 | Res, Cer, 1.5K, 1%, 1/8W, SM | 1082-768 | 1 |
| R58, 66 | Res, Cer, 681Ω, 1%, 1/16W, SM | 410334-065 | 2 |
| R59, 67 | Res, Cer, 8.66K, 1%, 1/16W, SM | 410334-067 | 2 |
| R62 | Res, Cer, 20M, 1%, 1/8W, SM | 1081-510 | 1 |
| R63 | Res, Cer, 332K, 1%, 1/8W, SM | 1082-874 | 1 |
| R64 | Res, Cer, 10M, 5%, 1/8W, SM | 1081-106 | 1 |
| R78, 79 | Res, 340 Ω, 1%, 1/8W, SM | 1082-790 | 2 |
| R80, 81 | Res, Cer, 10K, 1%, 1/8W, SM | 1082-104 | 2 |
| U1 | Volt Rgltr, Adj, SM LP2951A | 3076-001 | 1 |
| U2-4, 7, 8, 10, 11, 13 | Operational Ampl, Dual, SM TLC2272 | 412809-001 | 8 |
| U5 | Operational Ampl, SM TLC2201 | 403385-002 | 1 |
| U6 | Voltage Reference, 2.5V, SM AD680 | 410736-001 | 1 |
| U9 | Res, Ntwk, 10K, 0.1%, SM | 405134-001 | 1 |
| U12 | Analog Switch, SPST, CMOS, Quad DG413 | 408821-001 | 1 |
| U14-16 | DAC, 12-Bit, SM 7543 | 405439-001 | 3 |
| U17 | Data Acquisition, SM LTC1290 | 405948-002 | 1 |
| U18, 21, 22 | Res, Ntwk, 100K | 1049-203 | 3 |
| U19 | Inverter, Hex, SM HC04 | 3038-004 | 1 |

| Item | Parts List | Part Number | Qty |
|---|---|---|---|
| U20 | Counter, Binary, 4-Bit, Dual, SM HC393 | 3038-393 | 1 |
| U23 | EEPROM, Flash Memory, Tram $SpO_2$ (For -001 Only) | 414474-001 | 1 |
| U23 | EEPROM, Flash Memory, Tram $SpO_2$ (For -002 Only) | 414474-003 | 1 |
| U24 | Microcontroller, 16-MHz, SM 68332 | 408794-001 | 1 |
| U25 | Sensor, Undervoltage, 4.6V, SM MC34064D5 | 408952-001 | 1 |
| U26 | RAM, Static, 128K x 8-Bit, 70nS, SM 628128 | 406255-002 | 1 |
| U27, 28 | Isolator, Optically Coupled, SM 2611 | 408825-001 | 2 |
| U29 | EPROM, Tram $SpO_2$ Communication | 414443-001 | 1 |
| U30 | Programmable Peripheral Interface, PLCC 82C55A | 404697-001 | 1 |
| U31 | Converter, DC-to-DC, Isolated, ±5V | 413655-002 | 1 |
| U32 | Res Ntwk, 100K, SM | 1061-104 | 1 |
| U33 | Diode Pair Array, ESD/Overvoltage Protection, SM | 412586-001 | 1 |
| Y1 | Crystal, 31.2kHz, SM | 408946-001 | 1 |
| Y2 | Crystal Oscillator, 2.4576-MHz, SM (For -001 Only) | 411514-001 | 1 |
| Y2 | Crystal Oscillator, 3.6864-MHz, SM (For -002 Only) | 408828-001 | 1 |
| - | Socket, PLCC, 44-Pin, SM (For U29) | 402412-001 | 1 |
| - | Circuit Board (For -001 Only) | 800675-001A | 1 |
| - | Circuit Board (For -002 Only) | 800675-002A | 1 |
| - | Schematic Diagram (For -001 Only; Use -002 schematic diagram except for U29 and Y2 are different as noted in this parts list.) | SD8000674-001A | |
| - | Schematic Diagram (For -002 Only) | SD8000674-002A | |

# Schematic Diagram PN SD800674-002A

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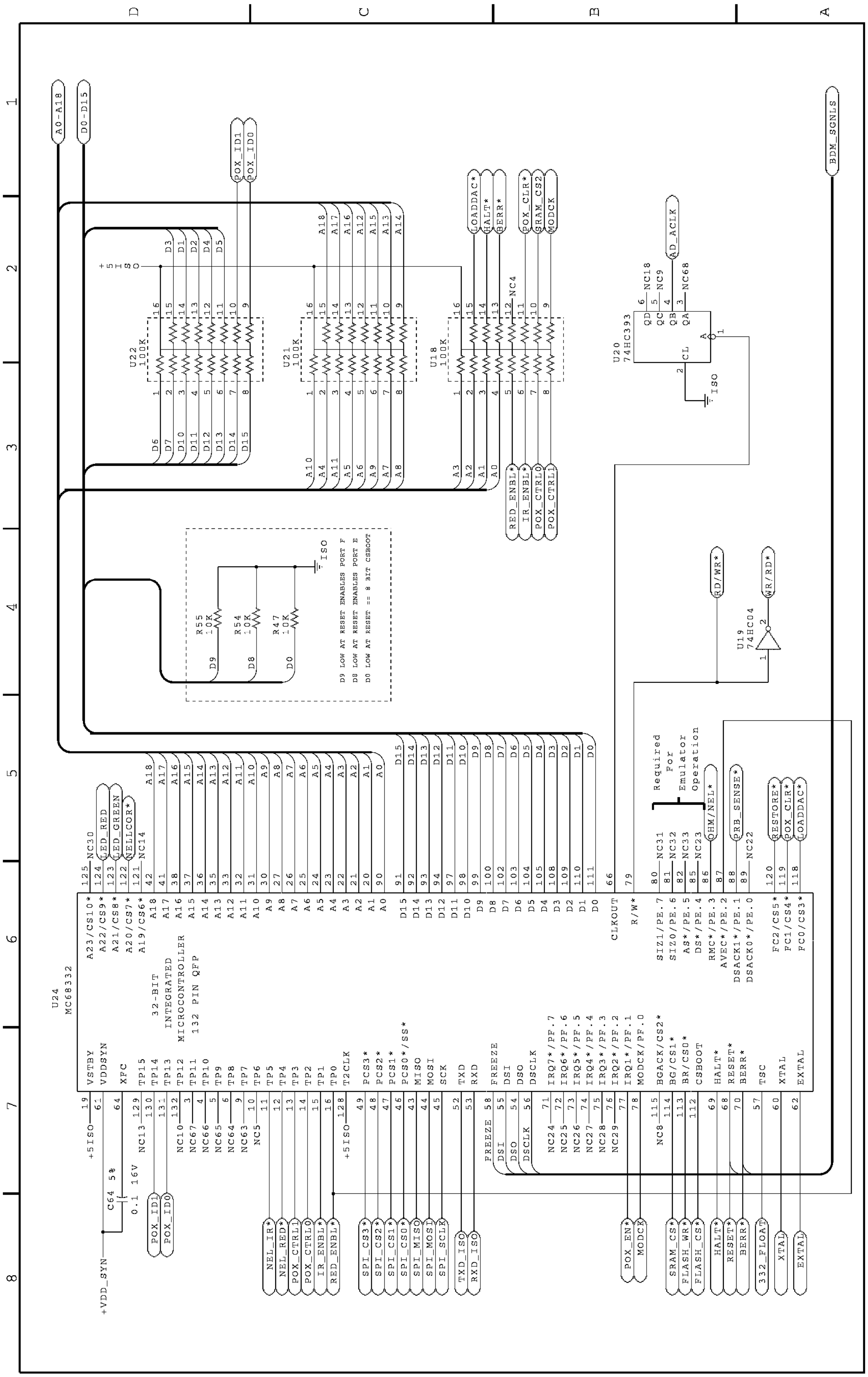
U24
MC68332
32-BIT
INTEGRATED
MICROCONTROLLER
132 PIN QFP
U22 100K
U21 100K
U18 100K
U20 74HC393
U19 74HC04
R55 10K
R54 10K
R47 10K
C64 5% 0.1 16V
D9 LOW AT RESET ENABLES PORT F
D8 LOW AT RESET ENABLES PORT E
D0 LOW AT RESET == 8 BIT CSBOOT
Required For Emulator Operation
A0-A18
D0-D15
POX_ID1
POX_ID0
LOADDAC*
HALT*
BERR*
POX_CLR*
SRAM_CS2
MODCK
AD_ACLK
BDM_SGNLS
RED_ENBL*
IR_ENBL*
POX_CTRL0
POX_CTRL1
RD/WR*
WR/RD*
LED_RED
LED_GREEN
NELLCOR*
OHM/NEL*
PRB_SENSE*
RESTORE*
+VDD_SYN
NEL_IR*
NEL_RED*
SPI_CS3*
SPI_CS2*
SPI_CS1*
SPI_CS0*
SPI_MISO
SPI_MOSI
SPI_SCLK
TXD_ISO
RXD_ISO
POX_EN*
SRAM_CS*
FLASH_WR*
FLASH_CS*
RESET*
BERR
332_FLOAT
XTAL
EXTAL
+5ISO
ISO

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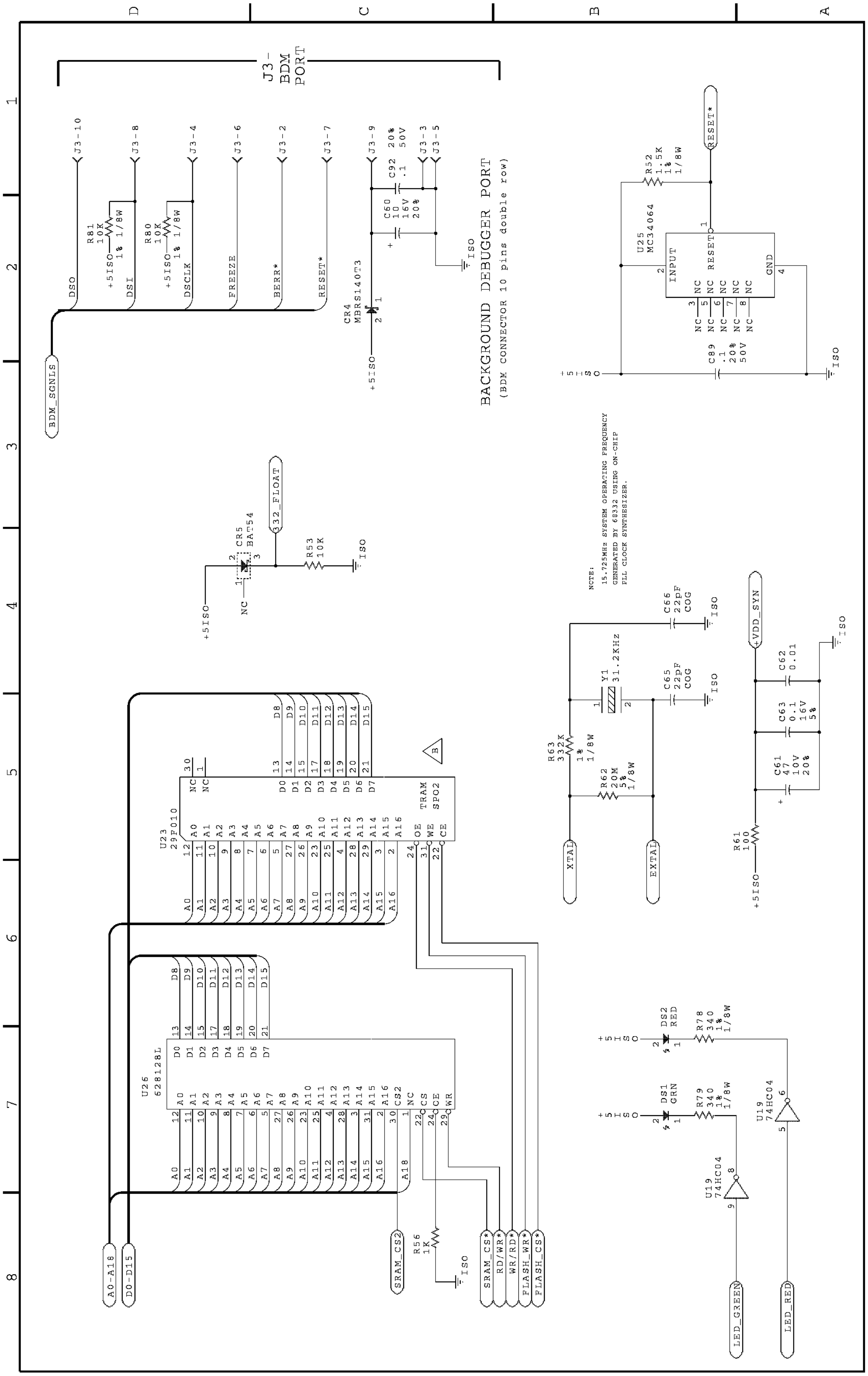
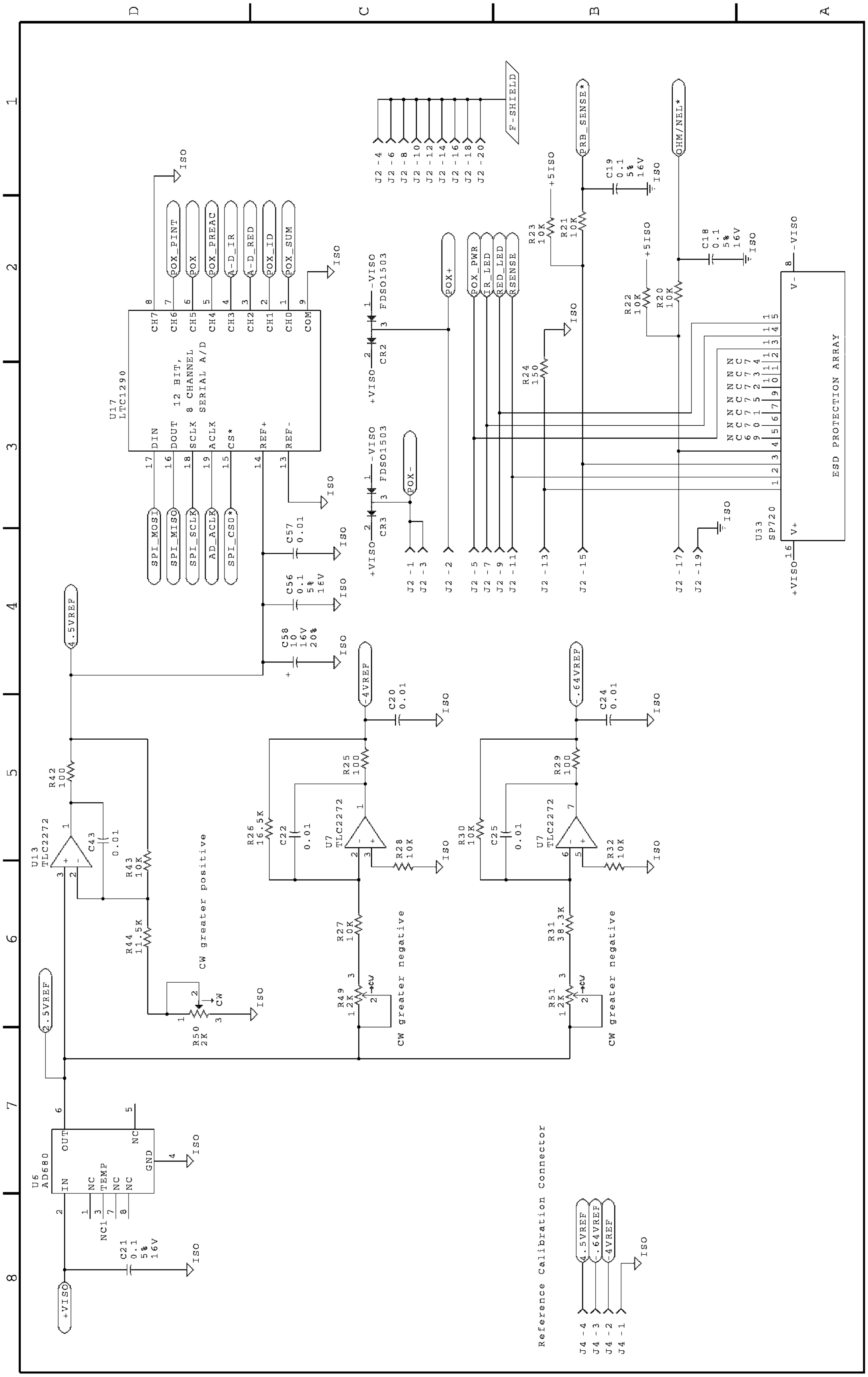

J3-BDM PORT
J3-10
J3-8
J3-4
J3-6
J3-2
J3-7
J3-9
J3-3
J3-5
R81 10K 1% 1/8W
R80 10K 1% 1/8W
+5ISO
DSO
DSI
DSCLK
FREEZE
BERR*
RESET*
BDM_SGNLS
C92 .1 20% 50V
C60 10 16V 20%
CR4 MBRS140T3
ISO
BACKGROUND DEBUGGER PORT
(BDM CONNECTOR 10 pins double row)
R52 1.5K 1% 1/8W
RESET*
U25 MC34064
INPUT
RESET
GND
NC
C89 .1 20% 50V
+5ISO
CR5 BAT54
332_FLOAT
R53 10K
NOTE:
15.725MHz SYSTEM OPERATING FREQUENCY
GENERATED BY 68332 USING ON-CHIP
PLL CLOCK SYNTHESIZER.
C66 22pF COG
Y1 31.2KHz
C65 22pF COG
R63 332K 1% 1/8W
R62 20M 5% 1/8W
XTAL
EXTAL
VDD_SYN
C62 0.01
C63 0.1 16V 5%
C61 47 10V 20%
R61 100
U23 29F010
TRAM SP02
OE
WE
CE
D0–D15
A0–A16
U26 628128L
CS2
CS
OE
WR
A18
SRAM_CS2
R56 1K
SRAM_CS*
RD/WR*
WR/RD*
FLASH_WR*
FLASH_CS*
A0-A18
D0-D15
DS2 RED
R78 340 1% 1/8W
DS1 GRN
R79 340 1% 1/8W
U19 74HC04
LED_GREEN
LED_RED
A
B
C
D
1
2
3
4
5
6
7
8

3 of 9


U17
LTC1290
12 BIT,
8 CHANNEL
SERIAL A/D
CH7
CH6
CH5
CH4
CH3
CH2
CH1
CH0
COM
DIN
DOUT
SCLK
ACLK
CS*
REF+
REF-
POX_PINT
POX
POX_PREAC
A-D_IR
A-D_RED
POX_ID
POX_SUM
SPI_MOSI
SPI_MISO
SPI_SCLK
AD_ACLK
SPI_CS0*
ISO
C57 0.01
C56 0.1 5% 16V
C58 10 16V 20%
4.5VREF
CR2
CR3
FDSO1503
+VISO
-VISO
POX+
POX-
POX_PWR
IR_LED
RED_LED
RSENSE
F-SHIELD
J2-1
J2-2
J2-3
J2-4
J2-5
J2-6
J2-7
J2-8
J2-9
J2-10
J2-11
J2-12
J2-13
J2-14
J2-15
J2-16
J2-17
J2-18
J2-19
J2-20
+5ISO
PRB_SENSE*
OHM/NEL*
C19 0.1 5% 16V
C18 0.1 5% 16V
R23 10K
R21 10K
R22 10K
R20 10K
R24 150
U33
SP720
ESD PROTECTION ARRAY
V+
V-
NC6
NC7
NC9
NC10
NC11
NC12
NC13
NC14
NC15
.4VREF
.64VREF
C20 0.01
C24 0.01
R25 100
R29 100
R26 16.5K
R30 10K
C22 0.01
C25 0.01
U7
TLC2272
R28 10K
R32 10K
R27 10K
R31 38.3K
R49 12K
R51 12K
CW greater negative
CW
U13
TLC2272
R42 100
C43 0.01
R43 10K
R44 11.5K
R50 2K
CW greater positive
2.5VREF
U6
AD680
IN
OUT
NC
TEMP
GND
C21 0.1 5% 16V
+VISO
Reference Calibration Connector
J4-1
J4-2
J4-3
J4-4
D
C
B
A
1
2
3
4
5
6
7
8

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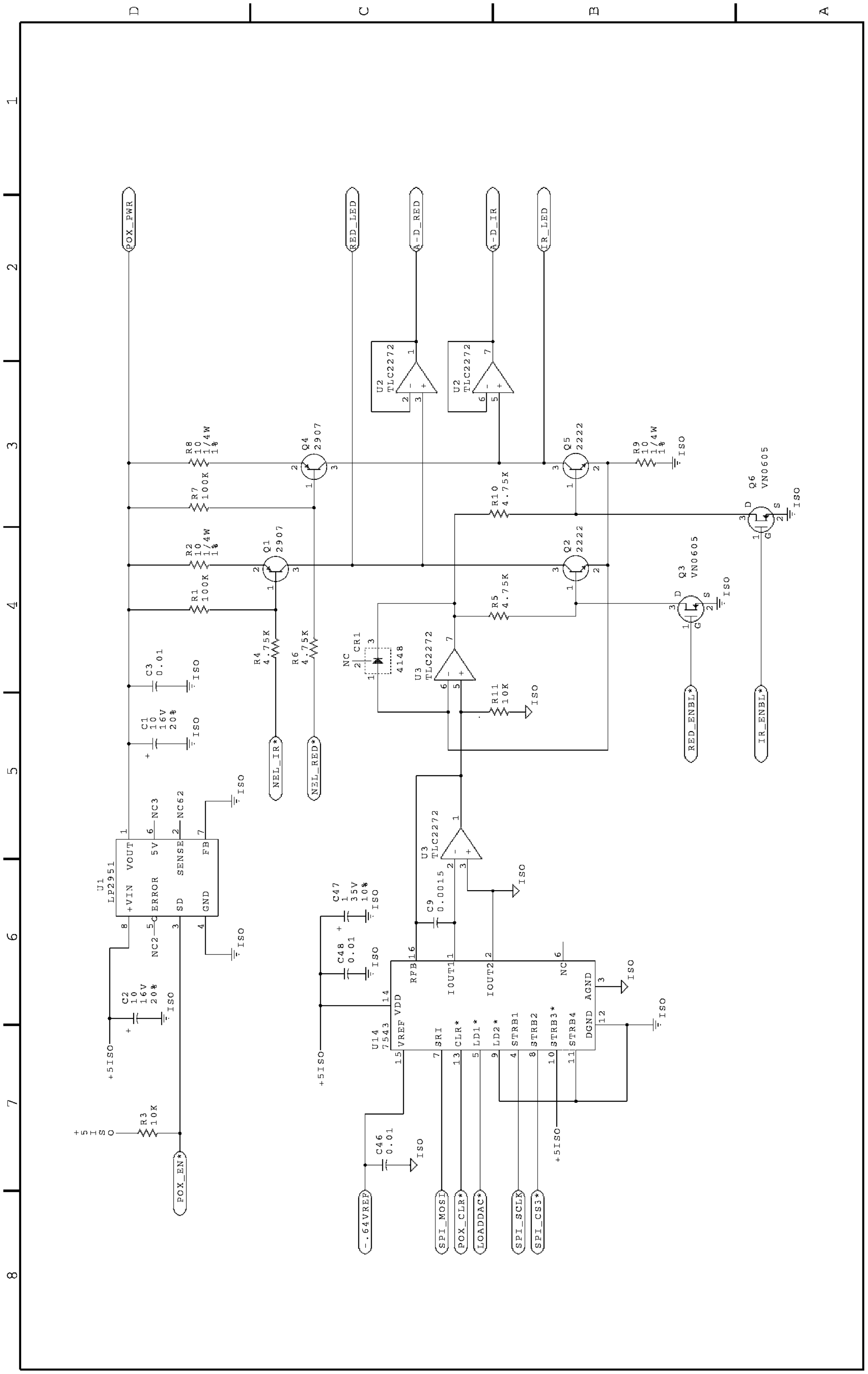
D
C
B
A
1
2
3
4
5
6
7
8
POX_PWR
RED_LED
A-D_RED
A-D_IR
IR_LED
U2 TLC2272
U2 TLC2272
U3 TLC2272
U3 TLC2272
R8 10 1/4W 1%
R7 100K
R2 10 1/4W 1%
R1 100K
R9 10 1/4W 1%
R10 4.75K
R5 4.75K
R4 4.75K
R6 4.75K
R11 10K
R3 10K
Q4 2907
Q1 2907
Q5 2222
Q2 2222
Q6 VN0605
Q3 VN0605
CR1 4148
NC
C3 0.01
C1 10 16V 20%
C2 10 16V 20%
C47 1 35V 10%
C48 0.01
C9 0.0015
C46 0.01
ISO
+5ISO
NEL_IR*
NEL_RED*
RED_ENBL*
IR_ENBL*
U1 LP2951
+VIN
VOUT
ERROR
5V
SENSE
SD
FB
GND
NC2
NC3
NC62
POX_EN*
U14 7543
VREF
VDD
RFB
IOUT1
IOUT2
NC
AGND
DGND
SRI
CLR*
LD1*
LD2*
STRB1
STRB2
STRB3*
STRB4
-.64VREF
SPI_MOSI
POX_CLR*
LOADDAC*
SPI_SCLK
SPI_CS3*

# PULSE OXIMETRY PCB: Schematic Diagram PN SD800674-002A

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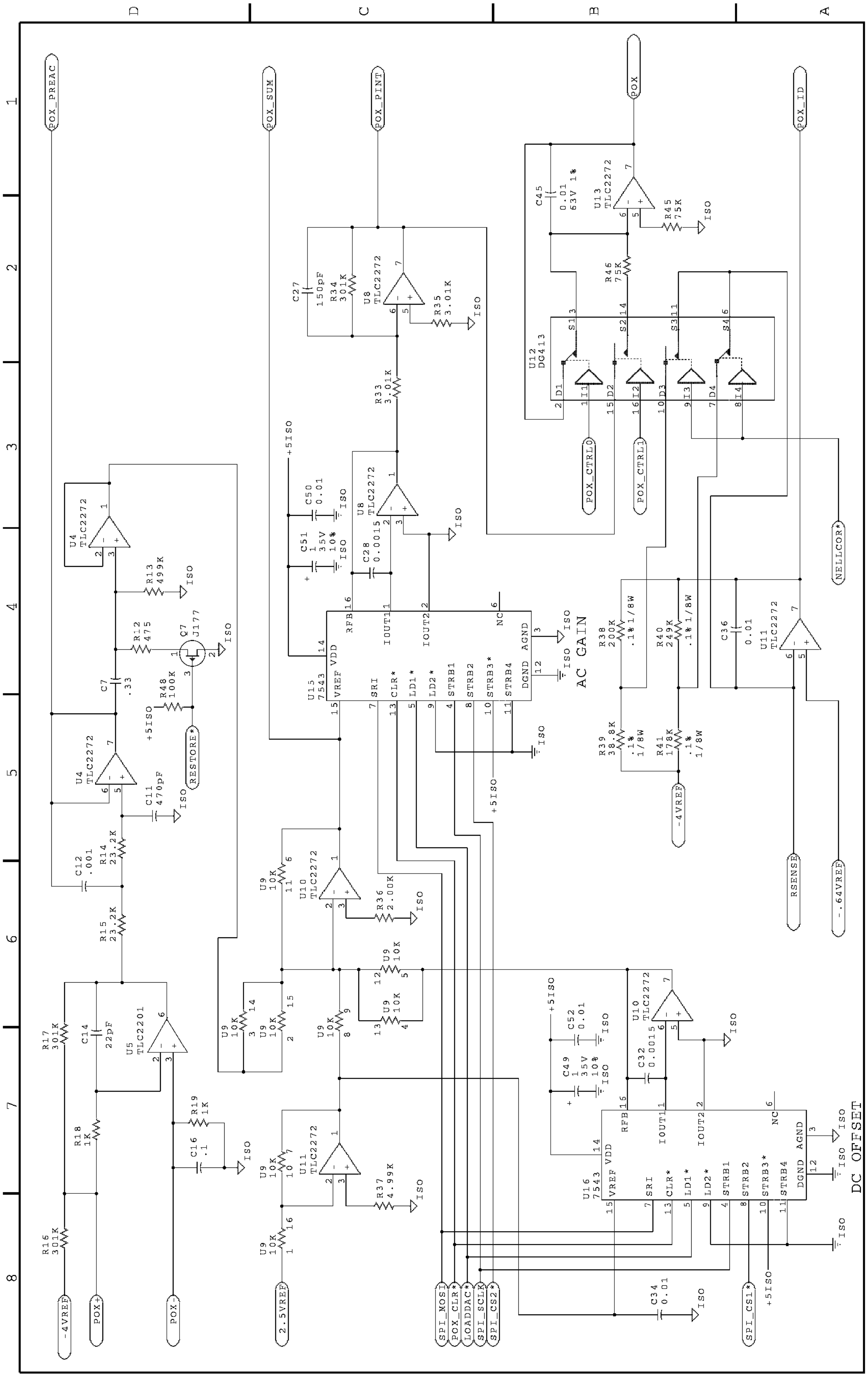
D
C
B
A
1
2
3
4
5
6
7
8
POX_PREAC
POX_SUM
POX_PINT
POX
POX_ID
U4 TLC2272
R13 499K
R12 475
Q7 J177
C7 .33
R48 100K
+5ISO
RESTORE*
C11 470pF
R14 23.2K
C12 .001
R15 23.2K
R17 301K
C14 22pF
U5 TLC2201
R18 1K
R19 1K
C16 .1
R16 301K
-4VREF
POX+
POX-
U9 10K
U10 TLC2272
R36 2.00K
U11 TLC2272
R37 4.99K
-2.5VREF
C27 150pF
R34 301K
U8 TLC2272
R35 3.01K
R33 3.01K
C50 0.01
C51 1 35V 10%
C28 0.0015
U15 7543
VREF VDD RFB IOUT1 IOUT2 NC AGND DGND
SRI CLR* LD1* LD2* STRB1 STRB2 STRB3* STRB4
AC GAIN
R38 200K .1% 1/8W
R40 249K .1% 1/8W
R39 38.8K .1% 1/8W
R41 178K .1% 1/8W
C36 0.01
NELLCOR*
RSENSE
-.64VREF
C45 0.01 63V 1%
U13 TLC2272
R45 75K
R46 75K
U12 DG413
S1 S2 S3 S4 D1 D2 D3 D4 I1 I2 I3 I4
POX_CTRL0
POX_CTRL1
C52 0.01
C49 1 35V 10%
C32 0.0015
U10 TLC2272
U16 7543
DC OFFSET
C34 0.01
SPI_MOSI
POX_CLR*
LOADDAC*
SPI_SCLK
SPI_CS2*
SPI_CS1*
ISO

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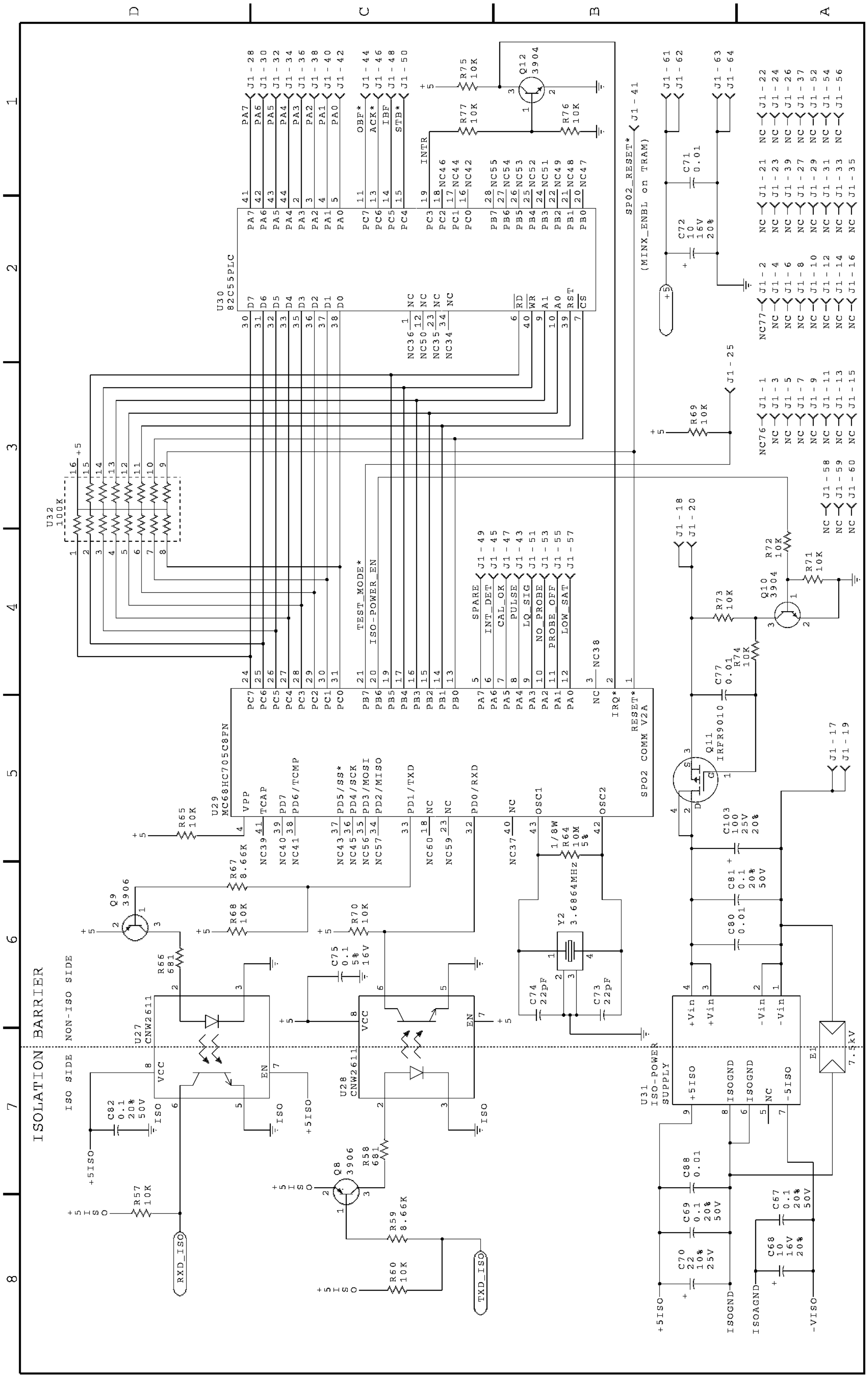

U30
82C55PLC
U29
MC68HC705C8FN
U32
100K
U27
CNW2611
U28
CNW2611
U31
ISO-POWER SUPPLY
Q9
3906
Q8
3906
Q10
3904
Q11
IRFR9010
Q12
3904
Y2
3.6864MHz
ISOLATION BARRIER
ISO SIDE
NON-ISO SIDE
RXD_ISO
TXD_ISO
SPO2_RESET*
(MINX_ENBL on TRAM)
SPO2 COMM V2A
TEST_MODE*
ISO-POWER_EN
SPARE
INT_DET
CAL_OK
PULSE
LQ_SIG
NO_PROBE
PROBE_OFF
LOW_SAT
INTR
OBF*
ACK*
IBF
STB*
+5ISO
ISOGND
ISOAGND
-VISO
E1
7.5kV
R64
10M
5%
1/8W
C74
22pF
C73
22pF
R65
10K
R67
8.66K
R68
10K
R70
10K
R66
681
C75
0.1
5%
16V
C82
0.1
20%
50V
R57
10K
R58
681
R59
8.66K
R60
10K
C88
0.01
C69
0.1
20%
50V
C70
22
10%
25V
C67
0.1
20%
50V
C68
10
16V
20%
C103
100
25V
20%
C81
0.1
20%
50V
C80
0.01
C77
0.01
R74
10K
R73
10K
R71
10K
R72
10K
R69
10K
C72
10
16V
20%
C71
0.01
R75
10K
R77
10K
R76
10K
D
C
B
A
1
2
3
4
5
6
7
8

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| IC POWER/RETURN CHART | | | | POWER SUPPLY BYPASS | | | |
|---|---|---|---|---|---|---|---|
| IC | | POWER | RETURN | REFD | VALUE | PWR | RTN |
| U29 | 68HC705 | 44 | 22 | C79 | 0.1 | +5 | GND |
| U30 | 82C55PLC | 29 | 8 | C76 | 0.1 | +5 | GND |

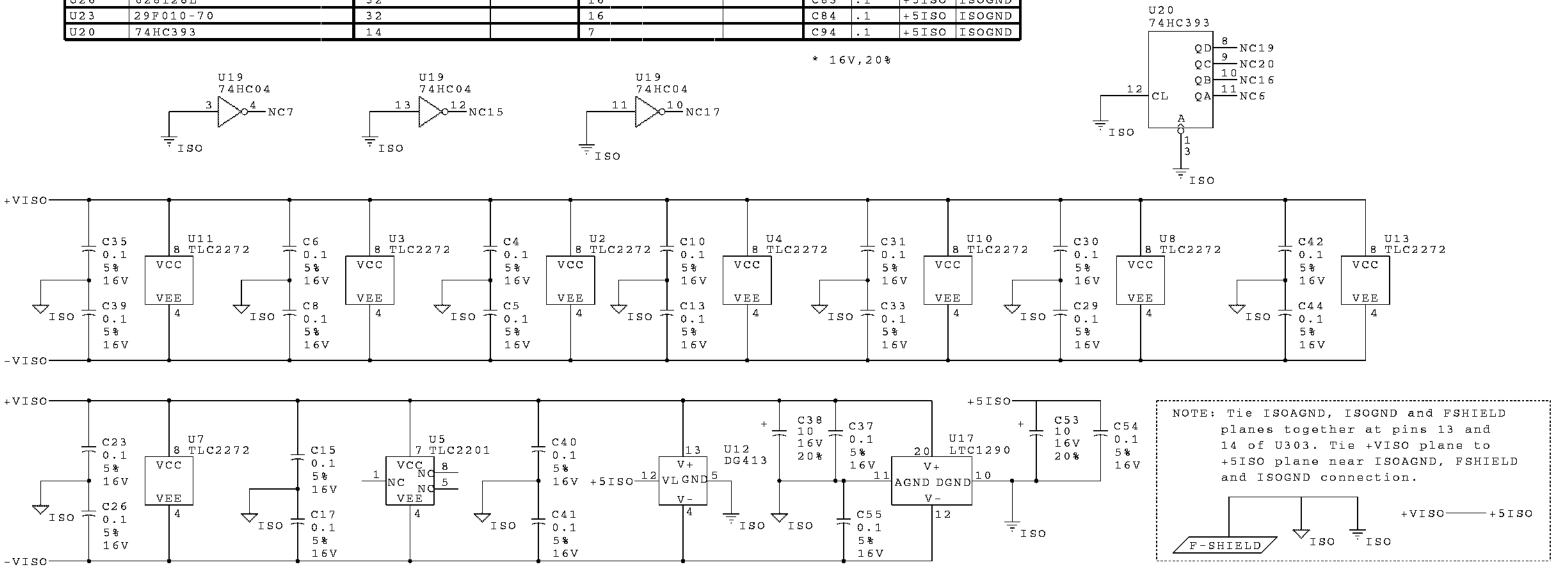
ISOLATION BARRIER

Non-iso Side

Iso Side

| IC POWER/RETURN CHART | | | | POWER SUPPLY BYPASS | | | | POWER SUPPLY BYPASS | | | | POWER SUPPLY BYPASS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IC | | POWER | RETURN | REFD | VALUE | PWR | RTN | REFD | VALUE | PWR | RTN | REFD | VALUE | PWR | RTN |
| U24 | MC68332 | 1,7,18,28,39,<br>50,63,65,84,<br>96,107,116,126 | 2,8,17,29,40,51<br>59,67,83,95,101<br>106,117,127,34 | C59 | 10* | +5ISO | ISOGND | C86 | .1 | +5ISO | ISOGND | C101 | .1 | +5ISO | ISOGND |
| | | | | C95 | .1 | +5ISO | ISOGND | C91 | .1 | +5ISO | ISOGND | C102 | .1 | +5ISO | ISOGND |
| | | | | C96 | .1 | +5ISO | ISOGND | C100 | .1 | +5ISO | ISOGND | | | | |
| | | | | C87 | .1 | +5ISO | ISOGND | C90 | .1 | +5ISO | ISOGND | | | | |
| | | | | C85 | .1 | +5ISO | ISOGND | C99 | .1 | +5ISO | ISOGND | | | | |
| | | | | C98 | .1 | +5ISO | ISOGND | C97 | .1 | +5ISO | ISOGND | | | | |
| U19 | 74HC04 | 14 | 7 | C93 | .1 | +5ISO | ISOGND | | | | | | | | |
| U26 | 628128L | 32 | 16 | C83 | .1 | +5ISO | ISOGND | | | | | | | | |
| U23 | 29F010-70 | 32 | 16 | C84 | .1 | +5ISO | ISOGND | | | | | | | | |
| U20 | 74HC393 | 14 | 7 | C94 | .1 | +5ISO | ISOGND | | | | | | | | |

* 16V,20%


U19
74HC04
3
4
NC7
ISO
U19
74HC04
13
12
NC15
ISO
U19
74HC04
11
10
NC17
ISO
U20
74HC393
QD 8 NC19
QC 9 NC20
QB 10 NC16
QA 11 NC6
12 CL
A
1
3
ISO
+VISO
-VISO
C35 0.1 5% 16V
C39 0.1 5% 16V
U11 TLC2272
C6 0.1 5% 16V
C8 0.1 5% 16V
U3 TLC2272
C4 0.1 5% 16V
C5 0.1 5% 16V
U2 TLC2272
C10 0.1 5% 16V
C13 0.1 5% 16V
U4 TLC2272
C31 0.1 5% 16V
C33 0.1 5% 16V
U10 TLC2272
C30 0.1 5% 16V
C29 0.1 5% 16V
U8 TLC2272
C42 0.1 5% 16V
C44 0.1 5% 16V
U13 TLC2272
VCC
VEE
8
4
C23 0.1 5% 16V
C26 0.1 5% 16V
U7 TLC2272
C15 0.1 5% 16V
C17 0.1 5% 16V
U5 TLC2201
7
1
NC
NC
NC
5
C40 0.1 5% 16V
C41 0.1 5% 16V
+5ISO
U12 DG413
13 V+
12 VL GND 5
V- 4
C38 10 16V 20%
C37 0.1 5% 16V
C55 0.1 5% 16V
U17 LTC1290
20 V+
11 AGND DGND 10
V- 12
+5ISO
C53 10 16V 20%
C54 0.1 5% 16V
ISO
F-SHIELD
+VISO
+5ISO

NOTE: Tie ISOAGND, ISOGND and FSHIELD planes together at pins 13 and 14 of U303. Tie +VISO plane to +5ISO plane near ISOAGND, FSHIELD and ISOGND connection.

| LABEL | PAGE COORDINATES |
|---|---|
| +5: | 6-B2,B3,B6,C1,C6,D3,D5,D6 |
| +5ISO: | 1-C7,D2,D7<br>2-A6,B3,B7,C3,D2,D4<br>3-B1,B2<br>4-B7,C7,D7<br>5-A8,B6,C3,C5,D5<br>6-B8,C7,C8,D7,D8<br>7-A1,A5,B3 |
| +VDD_SYN: | 1-D8<br>2-A4 |
| +VISO: | 3-A4,C3,C4,D8<br>7-A1,B8 |
| -.64VREF: | 3-B5,B8<br>4-C8<br>5-A6 |
| -4VREF: | 3-B8,C5<br>5-B5,D8 |
| -VISO: | 3-A2,C2,C3<br>6-A8<br>7-A8,B8 |
| 2.5VREF: | 3-D7<br>5-C8 |
| 332_FLOAT: | 1-A8<br>2-C4 |
| 4.5VREF: | 3-B8,D4 |
| A-D_IR: | 3-D2<br>4-C2 |
| A-D_RED: | 3-D2<br>4-C2 |
| A0: | 1-C3,C5<br>2-D6,D7 |
| A1: | 1-C3,C5<br>2-D6,D7 |
| A2: | 1-C3,C5<br>2-D6,D7 |
| A3: | 1-C3,C5<br>2-D6,D7 |
| A4: | 1-C3,C5<br>2-D6,D7 |
| A5: | 1-C3,C5<br>2-D6,D7 |
| A6: | 1-C3,C5<br>2-C6,D7 |
| A7: | 1-C3,C5<br>2-C6,C7 |
| A8: | 1-C3,C5<br>2-C6,C7 |
| A9: | 1-C3,C5<br>2-C6,C7 |

| LABEL | PAGE COORDINATES |
|---|---|
| A10: | 1-C3,D5<br>2-C6,C7 |
| A11: | 1-C3,D5<br>2-C6,C7 |
| A12: | 1-C2,D5<br>2-C6,C7 |
| A13: | 1-C2,D5<br>2-C6,C7 |
| A14: | 1-C2,D5<br>2-C6,C7 |
| A15: | 1-C2,D5<br>2-C6,C7 |
| A16: | 1-C2,D5<br>2-C6,C7 |
| A17: | 1-C2,D5 |
| A18: | 1-C2,D5<br>2-C7 |
| ACK*: | 6-C1 |
| AD_ACLK: | 1-B2<br>3-D4 |
| BERR*: | 1-A8,B2<br>2-C2 |
| CAL_OK: | 6-B4 |
| D0: | 1-B5,C4 |
| D1: | 1-B5,D2 |
| D2: | 1-B5,D2 |
| D3: | 1-B5,D2 |
| D4: | 1-B5,D2 |
| D5: | 1-B5,D2 |
| D6: | 1-B5,D3 |
| D7: | 1-B5,D3 |
| D8: | 1-C5,D4<br>2-C5,D6 |
| D9: | 1-C5,D4<br>2-C5,D6 |
| D10: | 1-C5,D3<br>2-C5,D6 |
| D11: | 1-C5,D3<br>2-C5,D6 |
| D12: | 1-C5,D3<br>2-C5,D6 |
| D13: | 1-C5,D3<br>2-C5,D6 |
| D14: | 1-C5,D3<br>2-C5,D6 |
| D15: | 1-C5,D3<br>2-C5,C6 |

| LABEL | PAGE COORDINATES |
|---|---|
| DSCLK: | 1-B7<br>2-D2 |
| DSI: | 1-B7<br>2-D2 |
| DSO: | 1-B7<br>2-D2 |
| EXTAL: | 1-A8<br>2-B6 |
| FLASH_CS*: | 1-B8<br>2-B8 |
| FLASH_WR*: | 1-B8<br>2-B8 |
| FREEZE: | 1-C7<br>2-D2 |
| HALT*: | 1-B8,C2 |
| IBF: | 6-C1 |
| INTR: | 6-C1 |
| INT_DET: | 6-C4 |
| IR_ENBL*: | 1-B3,C8<br>4-A5 |
| IR_LED: | 3-C2<br>4-B2 |
| ISO-POWER_EN: | 6-C4 |
| ISOAGND: | 6-A8 |
| ISOGND: | 6-B8 |
| LED_GREEN: | 1-D5<br>2-B8 |
| LED_RED: | 1-D5<br>2-A8 |
| LOADDAC*: | 1-A5,C2<br>4-C8<br>5-C8 |
| LOW_SAT: | 6-B4 |
| LQ_SIG: | 6-B4 |
| MODCK: | 1-B2,B8 |
| NELLCOR*: | 1-D5<br>5-A4 |
| NEL_IR*: | 1-C8<br>4-C5 |
| NEL_RED*: | 1-C8<br>4-C5 |
| NO_PROBE: | 6-B4 |
| OBF*: | 6-C1 |
| OHM/NEL*: | 1-B5<br>3-B1 |

| LABEL | PAGE COORDINATES |
|---|---|
| PA0: | 6-C1 |
| PA1: | 6-C1 |
| PA2: | 6-C1 |
| PA3: | 6-C1 |
| PA4: | 6-C1 |
| PA5: | 6-C1 |
| PA6: | 6-C1 |
| PA7: | 6-D1 |
| POX: | 3-D2<br>5-B1 |
| POX+: | 3-C2<br>5-D8 |
| POX-: | 3-C3<br>5-D8 |
| POX_CLR*: | 1-A5,B2<br>4-C8<br>5-C8 |
| POX_CTRL0: | 1-B4,C8<br>5-B3 |
| POX_CTRL1: | 1-B4,C8<br>5-B3 |
| POX_EN*: | 1-B8<br>4-D8 |
| POX_ID: | 3-C2<br>5-A1 |
| POX_ID0: | 1-D1,D8 |
| POX_ID1: | 1-D1,D8 |
| POX_PINT: | 3-D2<br>5-C1 |
| POX_PREAC: | 3-D2<br>5-D1 |
| POX_PWR: | 3-C2<br>4-D2 |
| POX_SUM: | 3-C2<br>5-C1 |
| PRB_SENSE*: | 1-B5<br>3-B1 |
| PROBE_OFF: | 6-B4 |
| PULSE: | 6-B4 |
| RD/WR*: | 1-B4<br>2-B8 |
| RED_ENBL*: | 1-B4,C8<br>4-B5 |
| RED_LED: | 3-B2<br>4-C2 |

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8 7 6 5 4 3 2 1

| LABEL | PAGE COORDINATES |
|---|---|
| RESET*: | 1-B8<br>2-B1,C2 |
| RESTORE*: | 1-A5<br>5-D5 |
| RSENSE: | 3-B2<br>5-A6 |
| RXD_ISO: | 1-C8<br>6-D8 |
| SP02_RESET*: | 6-B2 |
| SPARE: | 6-C4 |
| SPI_CS0*: | 1-C8<br>3-D4 |
| SPI_CS1*: | 1-C8<br>5-A8 |
| SPI_CS2*: | 1-C8<br>5-C8 |
| SPI_CS3*: | 1-C8<br>4-B8 |
| SPI_MISO: | 1-C8<br>3-D4 |
| SPI_MOSI: | 1-C8<br>3-D4<br>4-C8<br>5-C8 |
| SPI_SCLK: | 1-C8<br>3-D4<br>4-B8<br>5-C8 |
| SRAM_CS*: | 1-B8<br>2-C8 |
| SRAM_CS2: | 1-B2<br>2-C8 |
| STB*: | 6-C1 |
| TEST_MODE*: | 6-C4 |
| TXD_ISO: | 1-C8<br>6-C8 |
| WR/RD*: | 1-A4<br>2-B8 |
| XTAL: | 1-A8<br>2-B6 |

| REFDES | PAGE COORDINATES |
|---|---|
| U1: | 4-D6 |
| U2: | 4-C3<br>7-B5 |
| U3: | 4-C5,C6<br>7-B6 |
| U4: | 5-D4,D5<br>7-B4 |
| U5: | 5-D7<br>7-B6 |
| U6: | 3-D8 |
| U7: | 3-B6,C6<br>7-B7 |
| U8: | 5-C2,C4<br>7-B3 |
| U9: | 5-C6,C7,C8,D7 |
| U10: | 5-B7,C6<br>7-B4 |
| U11: | 5-A4,C7<br>7-B7 |
| U12: | 5-B3<br>7-B5 |
| U13: | 3-D6<br>5-B2<br>7-B2 |
| U14: | 4-C7 |
| U15: | 5-C5 |
| U16: | 5-B8 |
| U17: | 3-D3<br>7-B4 |
| U18: | 1-C3 |
| U19: | 1-A4<br>2-A7,B8<br>7-C5,C6,C7,C8 |
| U20: | 1-B3<br>7-C3,C8 |
| U21: | 1-C3 |
| U22: | 1-D3 |
| U23: | 2-D5<br>7-C8 |
| U24: | 1-D7<br>7-C8 |
| U25: | 2-B2 |
| U26: | 2-D7<br>7-C8 |
| U27: | 6-D7 |
| U28: | 6-C7 |

| REFDES | PAGE COORDINATES |
|---|---|
| U29: | 6-D5<br>7-D8 |
| U30: | 6-D2<br>7-D8 |
| U31: | 6-B7 |
| U32: | 6-D4 |
| U33: | 3-A4 |

| CONNECTOR | SIGNAL |
|---|---|
| J1-17: | 06030065 |
| J1-18: | 06054054 |
| J1-19: | 06030065 |
| J1-20: | 06054054 |
| J1-25: | TEST_MODE* |
| J1-28: | PA7 |
| J1-30: | PA6 |
| J1-32: | PA5 |
| J1-34: | PA4 |
| J1-36: | PA3 |
| J1-38: | PA2 |
| J1-40: | PA1 |
| J1-41: | SP02_RESET* |
| J1-42: | PA0 |
| J1-43: | PULSE |
| J1-44: | OBF* |
| J1-45: | INT_DET |
| J1-46: | ACK* |
| J1-47: | CAL_OK |
| J1-48: | IBF |
| J1-49: | SPARE |
| J1-50: | STB* |
| J1-51: | LQ_SIG |
| J1-53: | NO_PROBE |
| J1-55: | PROBE_OFF |
| J1-57: | LOW_SAT |
| J1-61: | +5 |
| J1-62: | +5 |
| J1-63: | GND |
| J1-64: | GND |

| CONNECTOR | SIGNAL |
|---|---|
| J2-1: | POX- |
| J2-2: | POX+ |
| J2-3: | POX- |
| J2-4: | FSHIELD |
| J2-5: | POX_PWR |
| J2-6: | FSHIELD |
| J2-7: | IR_LED |
| J2-8: | FSHIELD |
| J2-9: | RED_LED |
| J2-10: | FSHIELD |
| J2-11: | RSENSE |
| J2-12: | FSHIELD |
| J2-13: | 03067043 |
| J2-14: | FSHIELD |
| J2-15: | 03067046 |
| J2-16: | FSHIELD |
| J2-17: | 03067053 |
| J2-18: | FSHIELD |
| J2-19: | ISOGND |
| J2-20: | FSHIELD |
| J3-2: | BERR* |
| J3-3: | ISOGND |
| J3-4: | DSCLK |
| J3-5: | ISOGND |
| J3-6: | FREEZE |
| J3-7: | RESET* |
| J3-8: | DSI |
| J3-9: | 02086029 |
| J3-10: | DSO |
| J4-1: | ISOAGND |
| J4-2: | -4VREF |
| J4-3: | -.64VREF |
| J4-4: | 4.5VREF |

D C B A

*For your notes*